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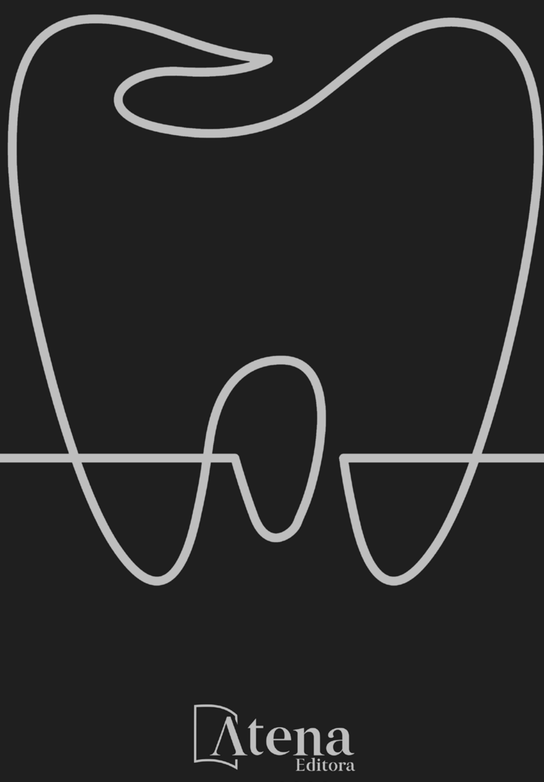
DENTAL ANATOMY AND MORPHOLOGY



Atena
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Ano 2022

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PRESENTATION

The curricular component of Dental Anatomy and Morphology provides dental students and faculty with the scientific foundations associated with anthropological, technical, and, artistic elements. There are numerous methodologies to approach the teaching of Dental Anatomy and Morphology. In this booklet, the content was distributed into five chapters, ending with the step-by-step of articulated teeth on a typodont used in the practices of the Dental Anatomy discipline. The sequence of chapters and their contents were arbitrarily determined, aiming at a didactic logic of presentation, for professionals and students who make Dentistry a mixture of art and science.

PREFACE

Learning is an endless path. The book "Dental Anatomy and Morphology" presents contributions to teaching in Dentistry. The texts were organized by professors from different national and international institutions, and these faculty are linked to different courses in dental school, such as Dental Anatomy and Sculpture, Occlusion, Dental Prosthesis, Implantology, and Dental Biomaterials. Therefore, the work brings to the construction of knowledge important concepts, notions, and techniques of anatomy and waxing management of dental structures. This production is one of the foundations of clinical practice in dentistry.

The various chapters of this work reveal how the knowledge of anatomy, dental sculpture, and occlusion converge and complement each other. They are presented in sequence with the intention of quality training and provide important subsidies for the steps that follow in the training.

The first chapter focuses on anatomical aspects of teeth and notions of occlusion, relevant to oral rehabilitation. The second chapter discusses the incisors and their main characteristics, rescuing concepts, and relates the theme to everyday aspects of clinic. The third chapter addresses canines and their importance in dental sculpture, as well as the main functions related to mastication and proprioception sensors. The fourth chapter is already intended for pre-molars(bicuspids) and the main anatomical and functional characteristics that these elements present. The fifth and final chapter describes molars and the stages of sculpting articulated teeth on typodonts, presenting aspects of practice and sculpting technique, and establishing bridges with dental specialties.

Nevertheless, to all characteristics attributed during all chapters, we highlight in particular the effort of the organizers to bring together a team of collaborators who enrich the work with their expertise. This first edition aimed to promote quality training in dentistry and provide students and professionals with didactic material for study and research. Finally, it is with a big and affectionate collective hug that the respective preface to this production, the result of the efforts of many, will be enjoyed by all. Enjoy reading!

SUMÁRIO

INTRODUCTION TO DENTAL ANATOMY

The teeth are arranged in upper and lower arches. Those teeth in the upper arch are termed maxillary because they are set in the maxilla. The teeth in the lower arch are termed mandibular because they are located in the mandible. The mandible is the movable member of the two jaws, while the maxilla is stationary. How the mandibular teeth contact the maxillary teeth is called occlusion. The term for the process of biting or chewing food is mastication. These two arches perform several functions such as chewing, soft tissue support, and articulation of words, and are fundamental for the aesthetics of the face. The human dentition is termed heterodont, which means it is comprised of different types, or classes, of teeth that perform different functions in the mastication process. In comparison, a homodont dentition is one in which all of the teeth are the same in form and type. This sort of dentition is found in some of the lower vertebrates. Man has two separate sets of teeth or dentitions; This is termed a diphyodont animal. First, are the deciduous teeth which will exfoliate and become replaced by the permanent dentition, which will remain until the end of life. The transitional phase when both deciduous and permanent teeth are present is called the mixed dentition period.

The primary dentition erupts in the mouth from about six months to two years of age. Normally there are 20 total deciduous teeth. There are normally 32 permanent teeth in the permanent dentition or adult dentition, and they erupt from 6-21 years of age (Tables 1 and 2).

Eruption Age (Years)				
	Mandible	Order	Maxilla	Order
Central Incisor	6-7	2	7-8	2
Lateral Incisor	7-8	3	8-9	3
Canine	9-10	4	11-12	6
First Premolar	10-11	5	10-11	4
Second Premolar	11-12	6	11-12	5
First Molar	6-7	1	6-7	1
Second Molar	12-13	7	12-13	7
Third Molar	17-21	8	17-21	8

Table. 1 - Permanent dentition in cases of normal eruption time.

Eruption Age (Months)				
	Mandible	Order	Maxilla	Order
Central Incisor	6	1	7 1/2	1
Lateral Incisor	7	2	9	2
Canine	16	4	19	4
First Premolar	12	3	14	3
Second Premolar	20	5	24	5

Table. 2 - Deciduous dentition in cases of normal eruption time.

As it was pointed out, man is a heterodont, which means that more than one type of tooth is found in human dentitions. Each complete quadrant of the permanent dentition contains eight teeth of differing types and functions, as follows: incisors, canines, premolars, and molars in the permanent dentition. It can thus be seen that there are 16 permanent teeth in a complete arch and a total of 32 teeth. Each quadrant of man's deciduous dentition contains the following types of teeth, all of which have a function similar to their permanent complements in the permanent dentition: incisors, canines, and molars. Therefore, there are five deciduous teeth per quadrant, ten per arch, and a total of twenty in the primary dentition. All teeth are attached to the bone at a fibrous joint called gomphosis, which has bonding fibers that start from the bone and adhere to the teeth through cementum, a dental structure present in the root. Ligaments through traction and compression work as a perfect shock absorber against the multidirectional forces on the tooth.

One can also refer to the incisors and canines as the “anterior teeth,” which are the ones closest to the midline of the mouth, while the premolars and molars are referred to as the “posterior teeth.”

The entire set of teeth and their supporting structures are called dental organs. The dental organ is composed of the tooth itself, which is a mineralized tissue, and the periodontium, which is presented around the tooth. The structure around the tooth appears in two ways: supporting periodontium and protective periodontium. The tooth itself is studied and divided in two different ways: structural division and anatomical division (Figure 1).

The supporting periodontium is composed of alveolar bone, periodontal ligament, and cementum. Alveolar bone is a progression of basal bone (maxilla and mandible) towards the teeth, creating a pocket (dental alveolus) in which the tooth is attached to the bone through collagen fibers that are called the periodontal ligament. The periodontal ligament allows the mobility of the tooth during multidirectional forces, with a system of traction and compression. The cementum is responsible for protecting the dentin at the root

portion as well as adhering the periodontal ligament fibers to the tooth. All these structures are normally not visible clinically, as they are covered by the protective periodontium called gingiva. The gingiva protects the entire supporting periodontium on part of the tooth. The natural characteristic of the gingiva is a pale pink color, with an orange peel appearance, a firm consistency on palpation, and no bleeding on probing.

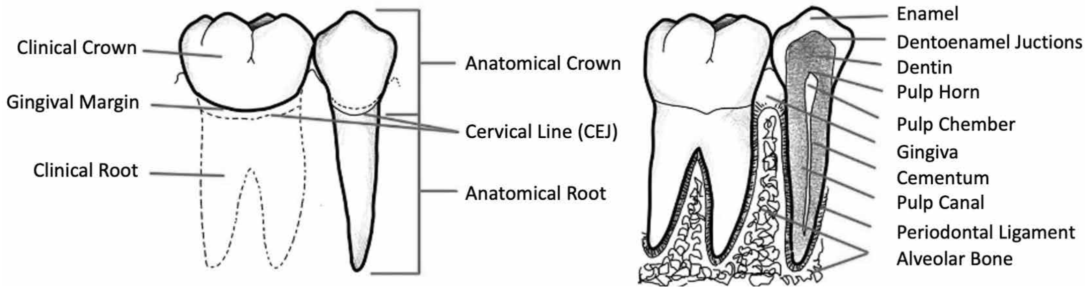


Figure 1. Structure and anatomical divisions.

Dental enamel is a highly crystalline structure composed of 98% of its constituents of mineral nature limiting the elasticity of the tissue, which protects the dentin in its coronal portion. It is highly resistant to compression, but is weak, and does not react very well to torsion. Dentin has a mineral content of approximately 70%, while the rest of its composition of proteins, lipids, and water provides a certain degree of elasticity, which is more resilient and forms the entire dental body surrounding the pulp. The pulp is the innermost part of the tooth and is the living part of the tooth, where vital anatomical structures such as blood vessels and arteries, nerves, and undifferentiated cells are present. The cementum protects the dentin in its root portion, and it also allows the periodontal ligament fibers to adhere to the tooth.

Anatomically, the tooth is divided into a crown, neck (cervical line), and root. The crown is covered with enamel, and the root portion is covered with cementum. The crown and root join at the cementoenamel junction (CEJ). This junction is also called the cervical line, and it is visible on a specimen tooth.

DENTAL STRUCTURES

DENTAL ELEMENT PARTS

A brief definition and description of the various anatomical features of a normal tooth, includes the following (Figure 2):

- **Crown:** it is the visible and functional portion of the tooth in mastication. It can be described as either the anatomical crown or the clinical crown. The anatomical crown is the portion located above the cervical line and is coated by enamel, while the clinical crown includes every part of the tooth that can be seen clinically in the oral environment, including parts of the root if they are exposed.
- **Root:** it fixes the teeth in the dental alveolus, through the periodontal ligament and cementum; it is always longer than the crown and is covered by a thin layer ofcementum and has a yellowish hue that stands out from the very light coloring ofthe crown. The root varies in size and quantity according to crown size and tooth group. Anterior teeth and some premolars usually have a single root with one apex or terminal end. Posterior teeth can have multiple roots, with a bifurcation or trifurcation dividing the root into two or more extensions or roots with their apices or terminal ends, as found on all molars and in some premolars. These roots start from what we call the root bulb, which is in the cervical third of the root, as it moves towards the free end, we reach the apex of the tooth. At the apex, we have the apical foramen, which can be single or multiple, and the nerves and vessels enter through them. The root faces have the same name as the corresponding crown faces.
- **Cervical line:** it is the intermediate segment between the crown and the root; it is the most strangulated part of the tooth and is limited by a sinuous line that interposes between the crown and the root. The anatomical neck or interface region represents exactly the dividing limits between the crown and root. On the other hand, the Surgical neck is related to the delimitation of the tooth area by the alveolar bone; remains always covered by the gingiva.

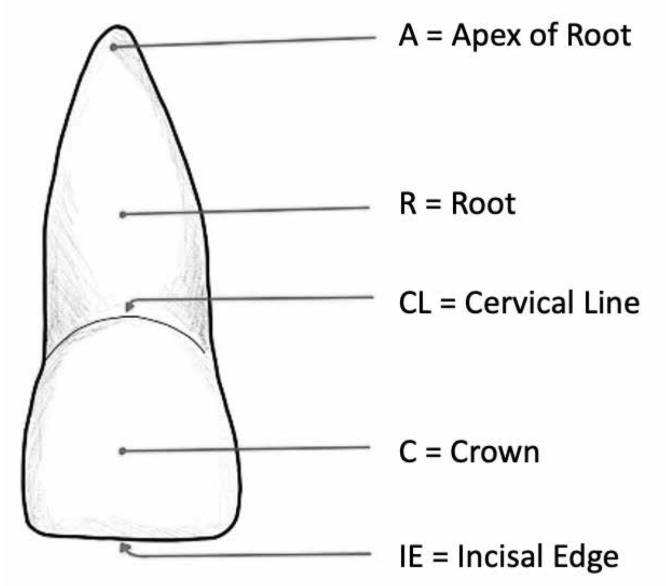


Figure. 2 - Maxillary Central Incisor (facial aspect); A=apex of root, R=root, CL= cervical line, C=crown, IE= incisal edge.

DENTAL GROUPS

Except for the two groups of homodont animals, the other mammals are heterodonts. The human dentition is an excellent example of heterodonts, and their teeth are classified according to their shape and function.

- **Incisors:** Incisors group of teeth in a total of 8 in the complete arches and they act in the section and prehension of the food and also in the phonation of certain consonants (c, d, l, n, t);
- **Canines:** a total of 4 teeth in the full arches and act in dilaceration (the act of tearing and reducing the food to smaller particles). Canines have a sharp tip and greater volume than the incisors;
- **Premolars:** a total of 8 teeth in the complete arches, functioning in the grinding of the food in molars; are intermediate teeth between the canines and molars;
- **Molars:** a total of 12 teeth in the complete arches, acting in the grinding of food. They are the most complex teeth in the dentition.

SURFACES

The teeth are like a cube, it has 6 surfaces, which are portions of what you see. Of these six surfaces, five are visible and one is imaginary. The visible ones are: labial

or buccal, lingual, mesial, distal, incisal or occlusal (Figure 3). The imaginary face is the cervical face that coincides with the cervical line. Among the visible faces, we have the free faces: buccal and lingual, close faces that contact adjacent teeth: mesial and distal, and action faces: incisal or occlusal, which in turn perform the function of the tooth itself in the case of incision and occlusion.

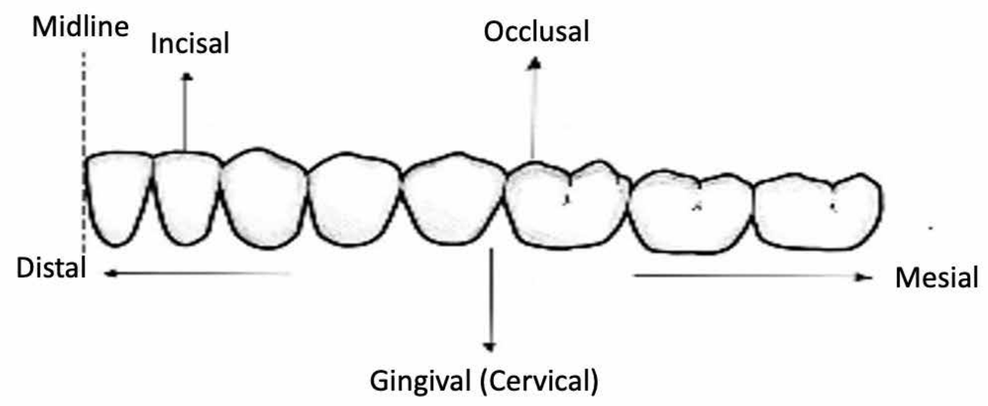


Figure. 3 – Principal tooth surfaces. It is imperative that the same terms need to be used consistently for the various anatomical areas of the teeth.

- **Labial surface:** in the incisors and canines, it is the surface toward the lips. It faces the vestibule of the mouth, the entrance to the mouth. It is the face that you can see right away when you smile.
- **Buccal surface:** in the premolars and molars, it is the face towards the cheek.
- When labial and buccal surfaces are spoken of collectively, they are called **Facial Surfaces**
- **Lingual/Palatine:** opposite the facial surface facing the oral cavity itself, always in direct contact with the tongue. In older literature, the lingual face was referred only to as the lower teeth, while the upper teeth were called the palatal face due to the palatal process of the maxilla. According to the evolution of the studies, they realized that when resting, the tongue rests on the incisive papilla, thus showing an intimate contact of the tongue with the upper teeth. Therefore, the term "lingual" can be used for both upper and lower teeth.
- The surfaces of the teeth facing adjacent teeth in the same dental arch are called **Proximal or Proximate surfaces**. The proximal surfaces may be called either mesial or distal.
- **Mesial surface:** those proximal surfaces that, following the curve of the arch,

are faced toward the midline. Closer to the middle of the face.

- **Distal surface:** those most distant from the median line, contact face that opposes the mesial face of an adjacent tooth.
- **Occlusal/Incisal:** is the surface of the teeth that functions when the mandible is closed against the maxila, considered the surface of dental action.

DIVISION OF THE CROWN INTO THIRDS

For purposes of description, the crowns and roots of teeth have been divided into thirds and junctions of the crown surfaces are described as line angles and point angles. No angles, points, or plane surfaces are on the teeth anywhere except where wear (attrition or abrasion) may have occurred or from accidental fracture. According to their location, the surfaces are divided into thirds (Figure 4).

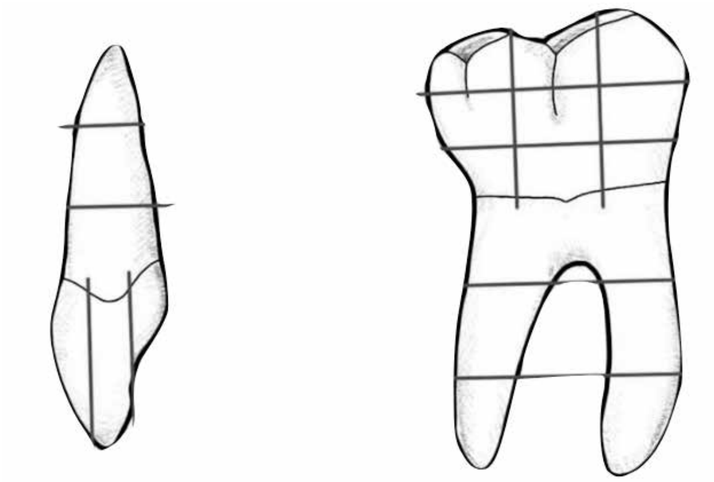


Figure. 4 - Division of the tooth into thirds.

Examining the tooth from the facial aspect, the crown/root may be divided into thirds from the incisal or occlusal surface of the crown to the root apex. The crown is divided into an incisal or occlusal third, a middle third, and a cervical third. And the root is divided into a cervical third, a middle third, and an apical third. The crown may be divided into thirds in three directions: incisocervically or occlusocervically, mesiodistally, or labio- or buccolingually. Mesiodistally, it is divided into mesial, middle, and distal thirds. Labio- or buccolingually is divided into labial or buccal, middle, and lingual thirds. Each of the five surfaces of a crown may be so divided. One middle third and two other thirds are named according to their location (Figure 5).

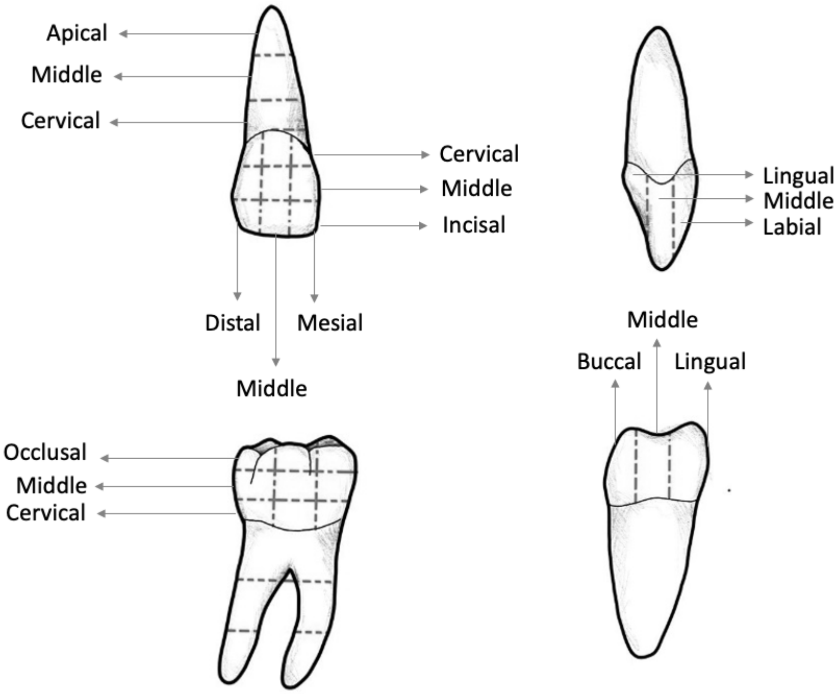


Figure. 5 - Labial/buccal, mesial, distal aspect into thirds.

The junction of two surfaces of the crown of a tooth is termed a "line angle", and the naming is derived from combining the names of those surfaces. The line angles of the anterior and posterior teeth are as follows figure. Anterior: Mesiolabial, distolabial, mesiolingual, distolingual, labioincisal, linguoincisal. Posterior: mesiobuccal, distobuccal, mesiolingual, distolingual, mesio-occlusal, disto-occlusal, bucco-occlusal, linguo-occlusal (Figure 6).

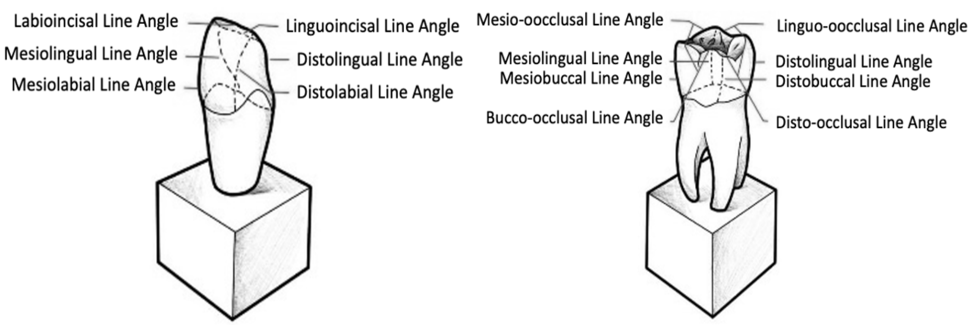


Figure. 6 - Line angles.

CONVERGENCE OF SURFACES

Tooth surfaces are not flat, they have slopes. These slopes are called convergences (Figure 7). The dental surfaces meet in one direction, which is called convergence, or, if in the opposite direction, a divergence. To understand the convergences, we must first observe which surface is being seen, then which direction is observed and which surfaces are parallel to that direction.

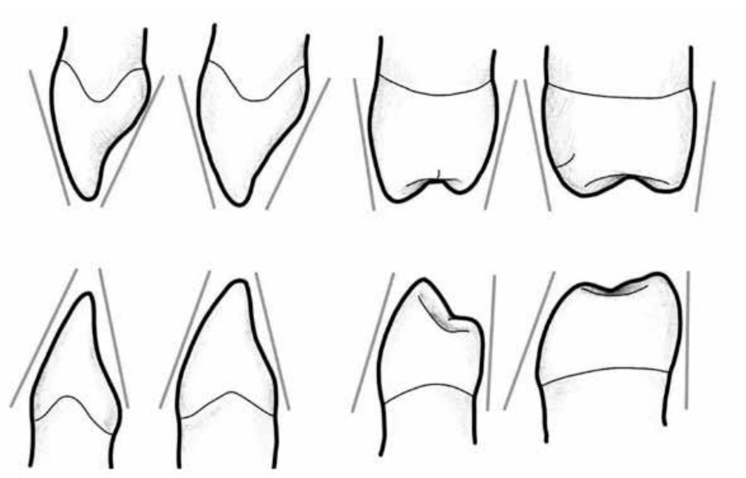


Figure. 7 - Surface convergence.

- **In a buccal or lingual view:** In the vertical incisal-cervical or occlusal-cervical direction, the proximal surfaces converge towards the cervical (root) (Figure 8).

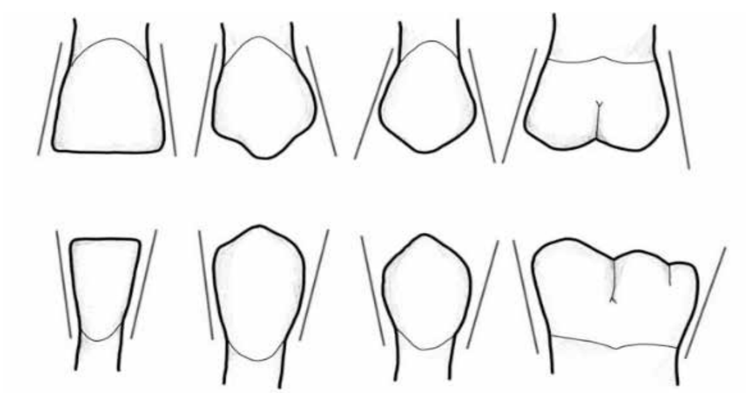


Figure. 8 - Buccal or lingual view.

- **In a buccal or lingual view:** In the mesiodistal horizontal direction, the incisal/occlusal and cervical surfaces converge distally.
- **In a proximal view (mesial or distal):** In the cervico-incisal or cervico-occlusal direction, the buccal and lingual surfaces converge towards the incisal/occlusal (Figure 9).

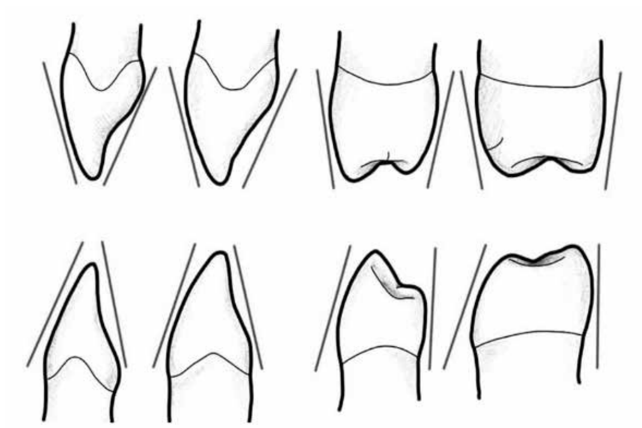
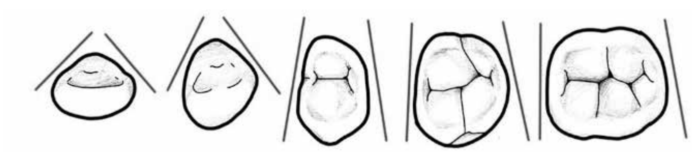


Figure. 9 - Buccal or lingual view.

- **In a proximal view (middle or distal):** In the buccolingual horizontal direction, the incisal/occlusal and cervical surfaces converge to the lingual.
- **Occlusal View:** In the buccolingual direction, the proximal surfaces converge to the lingual (except the 1st maxillary molar, and the 2nd mandibular premolar) (Figure 10).



- **Occlusal View:** In the mesiodistal direction, the buccal and lingual surfaces converge distally.

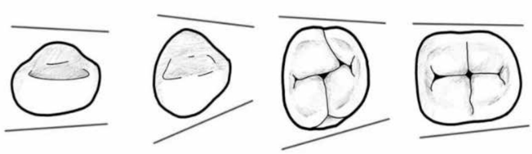


Figure. 10 - Occlusal view.

NOTATION AND NOMENCLATURE

The upper and lower dental arches can be divided in half by the midline which is called hemiarch, and the teeth and hemiarch of one side (right or left) are similar to those on the other side. Thus, to facilitate the location and positioning of the same in the arch, a name is received according to the groups and their dental position, using a rule.

Following this concept according to the groups.

- **Incisors:** there are two incisors on each hemiarch, one that is in the center of the arch, called the central incisor, and one that is lateral to it, the lateral incisor. With 4 incisors in each arch, there is a total of 8 incisors in the mouth. They have the function of incision of food, articulation of consonants, and contribute to facial aesthetics. The maxillary and mandibular central incisors are the only neighboring teeth in the dental arches with mesial surfaces in contact.

Following the rules for anterior teeth, we would have as an example of dental nomenclature:

Permanent maxillary left central incisor

Permanent mandibular right lateral incisor

- **Canines:** resembles the teeth of dogs, which originated its nomenclature. There is only 1 in each hemiarch, 2 in each arch, and thus 4 in total from both arches. The four canines are placed at the "corners" of the mouth. They are the longest teeth in the mouth. The shape and position of them contribute to the guidance of the teeth into the intercuspal position by "canine guidance". They function in tearing food. Nomenclature:

Permanent maxillary right canine

Permanent mandibular left canine

- **Premolars:** A group of transitional teeth that has canine characteristics and molar characteristics. There are two in each hemiarch, 4 in each arch, and 8 in total. They function in grinding food, helping to tear food and maintain the vertical dimension of the face. Premolars are only present in the permanent dentition in humans. Nomenclature:

1st maxillary right premolar

1st mandibular left premolar

- **Molars:** more complex teeth in the oral cavity. There are 3 in each hemiarch, and 6 in each arch, totaling 12. The 3rd molars can be excluded from this count, which can then be 2 in each hemiarch, 4 in each arch, and 8 in total. They function to crush food and maintain the vertical dimension of the face. Nomenclature:

1st Permanent maxillary right molar

2nd Permanent mandibular left molar

To facilitate communication between professionals in the dental field, two different methods were created. Despite its name, the Universal Numbering System is commonly used only in the United States. It is also called the “American system”. The Universal Numbering System, less used, has a simple idea: The maxillary teeth are numbered from 1 through 16, beginning with the right third molar, and continuing with the mandibular left third molar, the teeth are numbered 17 through 32. Thus, the right maxillary second premolar is designated as 4, the maxillary left central incisor as 9, and the right mandibular second molar as 31, for example.

The Universal Numbering System notation for the entire primary dentition uses uppercase letters for each of the primary teeth. The maxillary teeth, beginning with the right second molar, use the letter A through J, and mandibular teeth, letters K through T are used, beginning with the left mandibular second molar.

The international method or FDI two-digit notation works with the system of two digits, where the first represents the quadrant of the element as follows:

1- Permanent maxillary right quadrant

2- Permanent maxillary left quadrant

3- Permanent mandibular left quadrant

4- Permanent mandibular right quadrant

And the second number identifies the teeth, beginning from the midline. Examples:

1- Central incisor

2- Lateral incisor

3- Canine

4- 1st premolar

5- 2nd premolar

6- 1st molar

7- 2nd molar

8- 3rd molar

In this way, we join the two digits identifying the teeth in a specific quadrant. For example:

11 - permanent right upper central incisor

27 - 2nd permanent upper left molar

46 - 1st permanent lower right molar

In the deciduous dentition, it follows the same reasoning starting from the maxillary right quadrant with the number 5, following the clockwise direction.

hemiarch	teeth
5 - maxillary right deciduous	1 - central incisor
6 - maxillary left deciduous	2 - lateral incisor
7 - mandibular left deciduous	3 - canine
8 - mandibular right deciduous	4 - 1st molar
	5 - 2nd molar

Thus, putting the numbers together, we have:

54 - 1st upper right deciduous molar

63 - deciduous upper left canine

ANATOMICAL FEATURES

The dental crown has elevations and depressions that vary in size, shape, depth and appearance. And to study an individual tooth smartly, all landmarks of importance should be recognized by name. These morphological characteristics present in the teeth have a nomenclature as will be shown below.

First, the crown elevations.

Cusps are elevated and pointed projections of various sizes and shapes on the crowns of teeth (Figure 11).

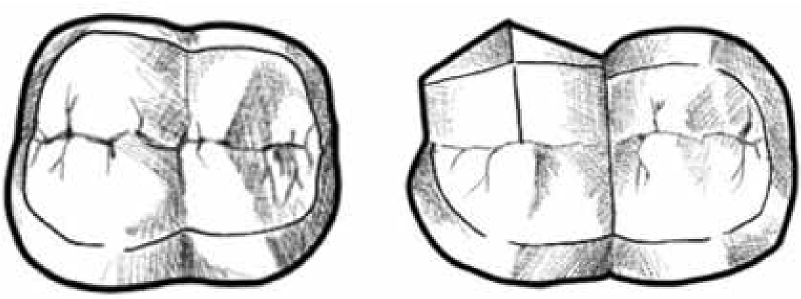


Figure. 11 - Cusps view.

Each cusp has four **cusp ridges** extending in different directions from its tip. They are named by the direction they extend from the tip.

- **Strands:** faces of a cusp that may be located on the buccal when on the buccal cusps, lingual when on the lingual cusps and may be called smooth or external slopes; and, when located on the occlusal surfaces, they are called grinding or internal.
- **Edges:** segments of straight lines (edge) formed by the union of slopes of the same cusp, can be:
    - Longitudinal: travel in the mesiodistal direction separating the free slopes from the occlusal slopes.
    - transversal: edges that cross the longitudinal edges and separate the distal from the mesial slopes

Ridges: any linear and usually convex enamel elevation present on the surface of a tooth and is named according to its location. Considered the highest point of convexity caused by the thickness of the enamel, they are of value in the stability of prosthetic appliances, keep the gingiva attached, protect the gingival marginal parts by deflecting food during chewing, allowing a slight degree of gingival friction, without the possibility of food forcing the teeth. If the ridge is very prominent, it promotes excessive displacement of the food bolus, leaving the gingiva without stimulation, thereby causing gingival atrophy. On the other hand, when the ridge is small, it allows strong and excessive food contact with the gingiva, thus causing irritation and inflammation of the gum due to exaggerated stimulation.

Marginal ridges are those rounded linear elevations of the enamel that form the mesial and distal margins of the occlusal surfaces of premolars and molars. It unites the buccal and lingual cusps. Also, found on anterior teeth, the mesial and distal margins of the lingual surfaces of the incisors and canines. Reinforcing the periphery of these faces, making it an important area for supporting forces (Figure 12).

Triangular ridges are named because the slopes of each side of the ridge are inclined to resemble two sides of a triangle. They descend from the tips of the cusps of posterior teeth toward the central area of the occlusal surface. When a buccal and a lingual triangular ridge join, they form a **transverse ridge**. The **oblique ridge** is a special type of transverse ridge, which crosses obliquely the occlusal surface of maxillary molars. It is an enamel protrusion that joins the buccal and lingual cusps. Specific characteristics of two dental elements: 1st maxillary molar and 1st mandibular premolar. In the maxillary 1st molar, the enamel bridge connects the mesiolingual to the distobuccal cusps. In the lower 1st premolar, it connects the

buccal and lingual cusp. Always interrupting the central groove. Mesial marginal ridges are taller and slender, distal ridges are short and wide.

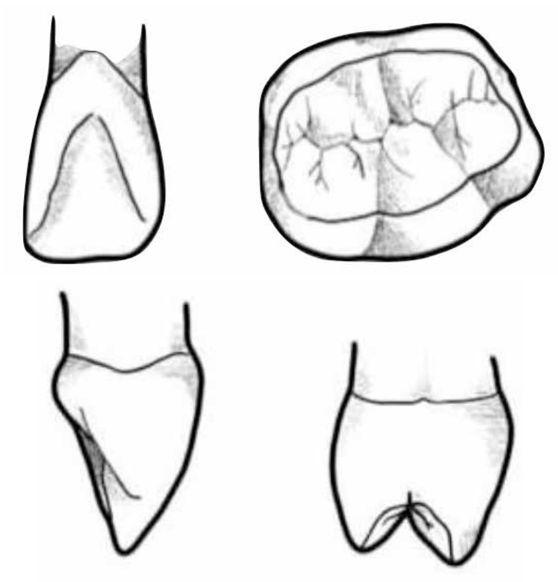


Figure. 12 - Marginal ridges.

Tubercles are rounded or pointed projections on crowns of teeth variable in size and shape, but usually smaller than cusps. The Cusp of Carabelli, a tubercle, is a normal finding on the mesial part of the lingual surface of permanent maxillary first molars and is an example of a tubercle.

Equatorial Line: Separates the retentive area from the expulsive area. It is an imaginary line that can be drawn by circling the most convex surfaces of a tooth: the lingual, buccal, and proximal (Figure 13).

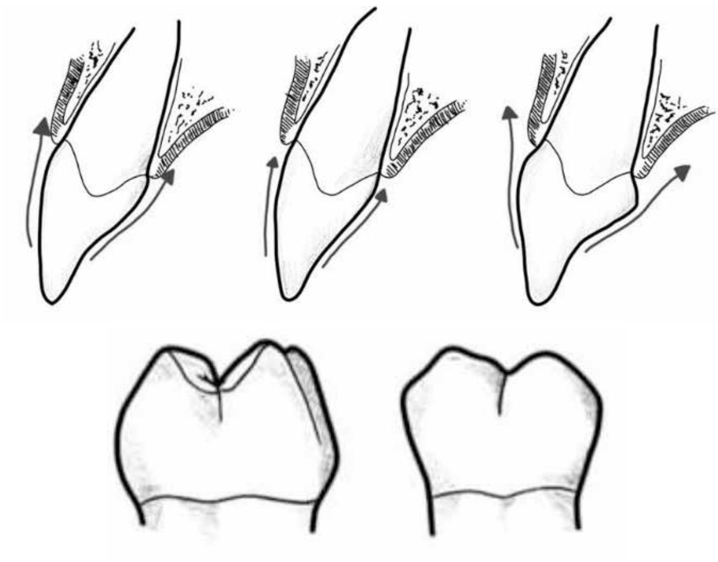


Figure. 13 - Equatorial lines.

A Retentive area on the maxillary teeth is above the equator and on the mandibular teeth it is below the equator and the expulsive area is the opposite of the retentive area.

Cingulum: or girdle, is the lingual lobe of an anterior tooth and makes up the bulk of the cervical third of the lingual surface. It is a sharp protrusion on the lingual surface of anterior teeth, representing a vestige of an undeveloped lingual cusp. It is an area susceptible to carious lesions.

Mamelons: Small, rounded projections of enamel that are found in varying sizes and numbers on the incisal ridges of recently erupted incisors. They are normally worn away rather soon after eruption if the tooth contacts its antagonist(s) in the opposite arch when in function. Now, it will be shown the crown depressions.

Fossa: Wide irregular depression or concavity of variable depth, located preferably on the lingual surface of the incisor and sometimes canine teeth. Particularly in the lower incisors, it is almost imperceptible. Lingual fossa is on the lingual surface of incisors. Central fossae are on the occlusal surface of molars. They are formed Dental Structures 17 by the convergence of ridges terminating at a central point in the bottom of the depression where a junction of grooves occurs.

Development lobes: These are primary centers of development of the dental element during embryogenesis, merging and being separated by grooves that accompany their nomenclature with developmental grooves. Usually, teeth have 4 lobes, in incisors, this lobe is divided into 3 labial (mesial, median, and distal),

and 1 lingual that is represented by the cingulum. In the posterior teeth, in the case of premolars, there are 3 buccal and 1 lingual, which is represented by the lingual cusp. In the case of molars, each cusp represents a free end of the developmental lobes. In the case of the mandibular 1st molar, it is not uncommon to have 5 developmental lobes, each one representing a cusp, as well as the mandibular 2nd premolar, where it has three cusps with 3 lobes on the buccal and 2 on the lingual surface, each of the latter representing a lingual cusp (Figure14).

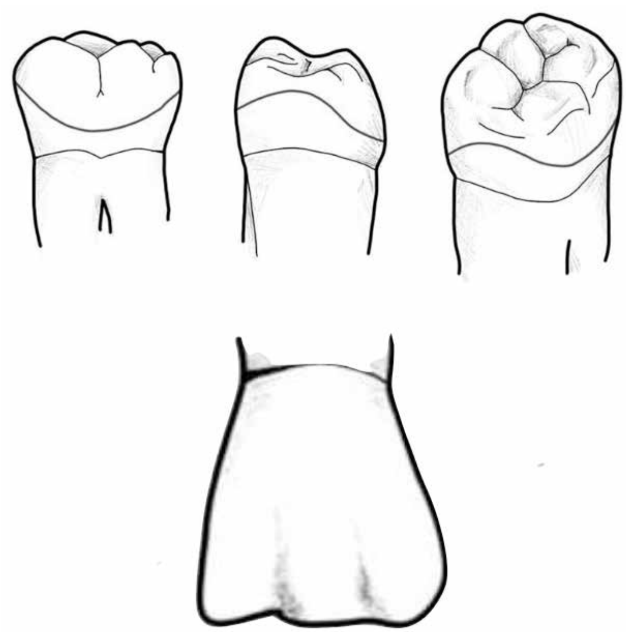


Figure. 14 - Development lobes.

Development grooves are shallow grooves or lines between the primary parts of a crown or root. Linear depressions on the buccal surface accompany the long dental axis, separating the developmental lobe. Its evidence characterizes young teeth, because in adults, due to friction between the lips and cheeks, they usually disappear (Figure 15).

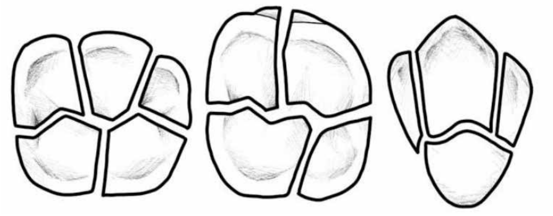


Figure. 15 - Structures are separated by the developmental lobes in occlusal view.

The pit in lingual fossa: Small, deep pointed depression in some teeth, usually maxillary lateral incisor and maxillary canine. Caused by the poor coalescence of enamel existing between the cingulum, or usually found in the deepest portion of a fossa (Figure 16).

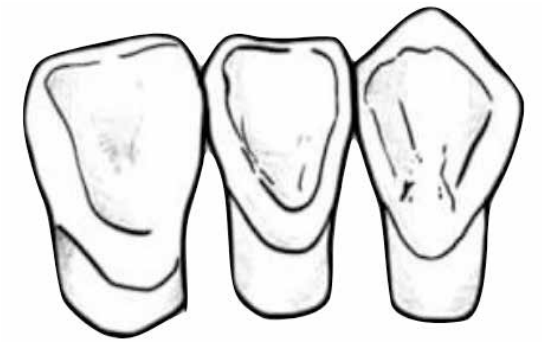


Figure. 16 - Pit in lingual fossa.

Fossa: Depressions, usually triangular, in some cases lozenge, of variable depth located in the path of the longitudinal groove of the occlusal surface and median of the buccal surface and rarely on the lingual of the posterior teeth. Of significant clinical value, as it is where the destructive processes of the coronary enamel are constantly initiated. Generally, in premolars, there are two - mesial and distal. In molars, there are four: one on the buccal and three on the occlusal: central, mesial, and distal. The mesial and distal pits are at the ends of the main groove on the occlusal surface, the central one is located in the center of the occlusal surface and the buccal one is located as a slight depression in the middle 1/3 of the buccal surface, marking the end of the groove that invades this surface. The lingual, when present, is located in the 1/3 of the middle of the occlusal lingual surface.

- **Grooves:** A linear depression, usually pronounced, that separates one cusp from another.
    - **Longitudinal or mesiodistal:** Run in the mesiodistal direction separating the buccal from the lingual cusps, and are usually centered on or closer to the lingual cusp (causing the difference in volume between the cusps). They are often not continuous and present as a broken or sinuous line; however, they always start from one pit proximal to the other. They can be almost straight (upper molars), straight (upper premolars and lower molars) or curvilinear (lower premolars).
    - **Buccal or occlusal-buccal:** Part of the central pit and runs towards the buccal surface ending in a buccal pit of the same, separating the buccal cusps, usually the buccal-distal and buccal-mesial;
    - **Lingual or occlusal-lingual on lower teeth and distolingual on upper teeth:** In maxillary teeth, part of the distal pit runs towards the lingual cusps separates the cusps into lingual-distal and lingual-mesial, in the lower teeth it starts from the central pit towards the lingual surface and separates the lingual-distal and lingual-mesial cusps (Figure 17).

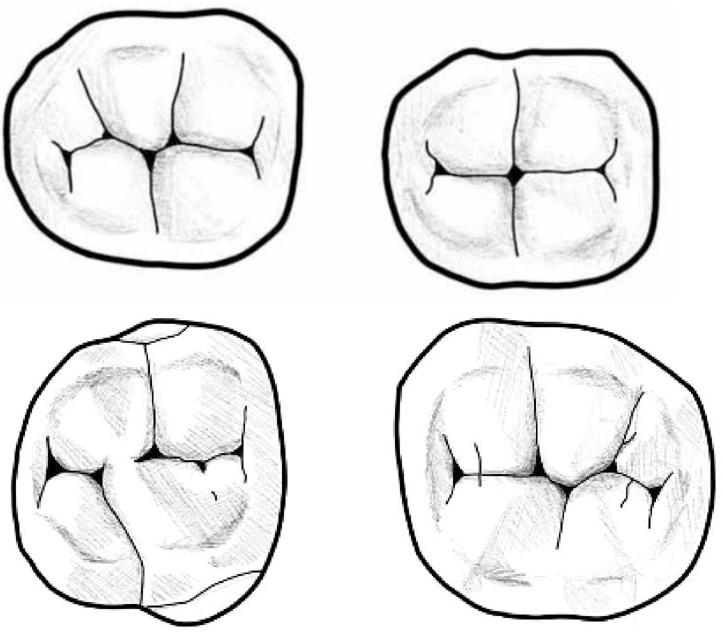


Figure. 17 - Occlusolingual lower teeth and distolingual on upper teeth.

- **Anatomical Occlusal Surface x Functional Occlusal Surface**

The occlusal surface is delimited by the longitudinal edges (buccal and lingual), and the marginal ridges (mesial and distal). The anatomical surface, on the other hand, takes the occlusal thirds of the buccal and lingual faces, increasing the masticatory surface. The cusps with the greatest occlusal contact are the VIPS cusps. When the teeth in the mandibular arch come into contact with those in the maxillary arch in any functional relation, they are said to be in occlusion. The term occlusion is also used to designate the anatomical alignment of the teeth and their relationship to the rest of the masticatory system.

The general arrangement of both arches and the leaning of the individual teeth are related in such a manner as to allow the most efficient use of the forces of mastication, while at the same time stabilizing and protecting the dental arches. The curve of Spee is the curvature that begins at the tip of the canines and follows the buccal cusp tips of the premolars and molars posteriorly when viewed from their facial aspect (Figure 18). The curve of Wilson is the mediolateral curvature of the occlusal plane of posterior teeth (Figure 19). For the occlusal surfaces of the posterior teeth to conform to this curve, the crowns of mandibular posterior teeth must incline to the lingual, while the crowns of maxillary posterior teeth must incline toward the buccal.

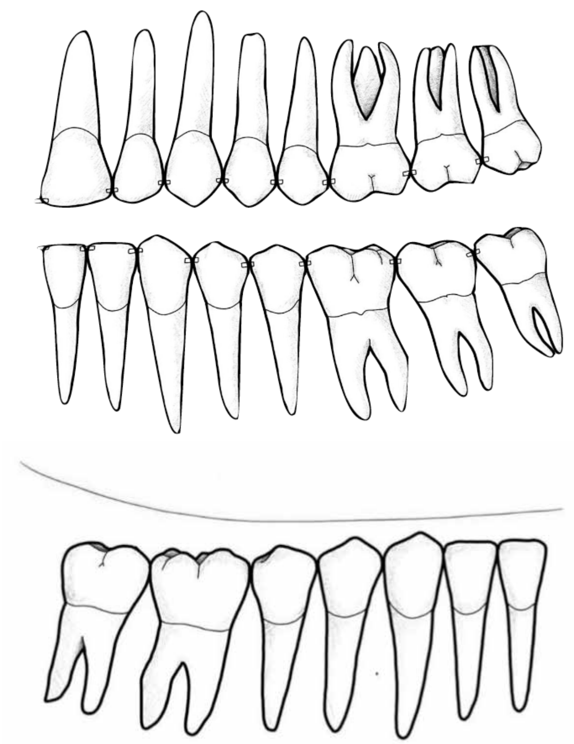


Figure. 18 - Curve of Spee.

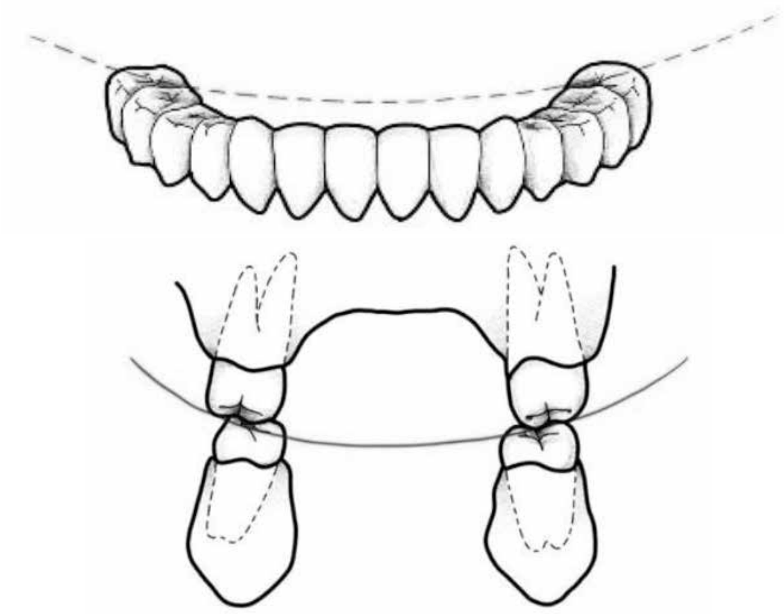


Figure. 19 - Curve of Wilson.

CONTACT AREAS

- **Contiguity contact point:** areas or places where the teeth touch. Proximal contacts of approximating teeth in the arch protect the soft tissues between teeth and are referred to as the interproximal spaces. The proper contact relation between neighboring teeth in each arch is important for the following reasons: it serves to keep food from packing between teeth, and it helps stabilize the dental arches by the combined anchorage of all the teeth in either arch in positive contact with each other.
- **(1) Interdental sulcus:** looking buccally or lingually is the space that starts from the contact area in an incisal/occlusal direction.
- **(2) Interdental Space:** space existing from the area of interproximal contact towards the cervical portion of the crown, seen buccally or lingually, is where the interdental papilla is housed.
- **(3 and 4) Embrasures:** triangular space seen by buccal (3) or lingual (4) occlusal basis, located between the contact faces of two teeth of the same arch. Lingual embrasures are larger than facial embrasures; The form of embrasures serves two purposes: to provide a spillway for food during mastication and prevent food from being forced through the contact area (Figure 20).

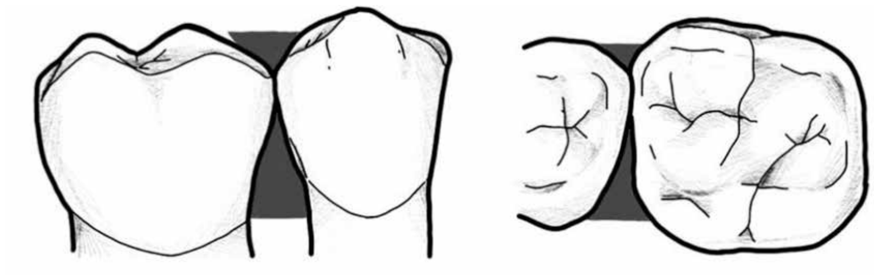


Figure. 20 - Embrasures.

- **Antagonist Contact Point:**

The teeth have contact with the opposite arch, which follows the ratio of contact 2 to 1. This ratio is when two teeth touch one, for example, 2 maxillary teeth with 1 mandibular tooth, excepted two elements the Mandibular central incisor and maxillary third molar that features only 1 antagonist touch. The upper arch covers the lower arch both vertically and horizontally for various reasons, both skeletal and dental reasons. However, we then have what we call overjet and overbite.

- Overjet: horizontal overlap, also known as overjet, this overlap can be positive, which is how much the upper tooth is in front of the lower (ideal), or negative, when the upper tooth is behind the lower tooth. These distances are measured by the distance from the buccal edge of the upper teeth to the buccal edge of the lower teeth. Ideally, this distance should be 4 to 6 mm (Figure 21).
- Overbite: known as an overbite, is the distance between the incisal edges of the upper and lower incisors. Positive measurements when the upper cover the lower, negative measurements when the lower covers the upper. Ideally, this distance should be 3 to 4mm (Figure 21).

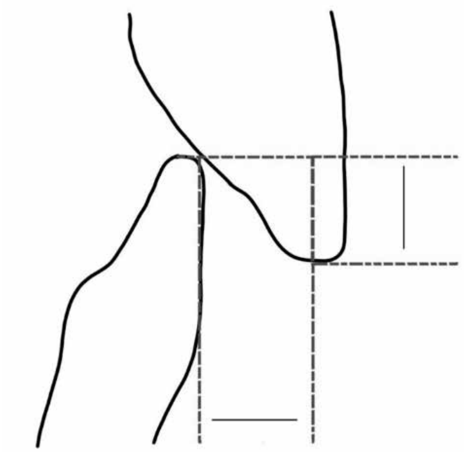


Figure. 21 - Overjet in the horizontal plane, and overbite in the vertical plane.

- The mesial surface is larger and flatter: The angle between crown and root is approximately 180º (except worn mandibular central incisor). The distal face is smaller and more convex: the angle between crown and root is less than 180º (except worn mandibular central incisor);
- The buccal surface is lingually inclined, being more evident in the mandibular arch.
- The roots have deviations to the distal; explained by the artery that nourishes the teeth being in a distal position (i.e. coming from the distal to the mesial).

INCISORS

- **Purpose:** The incisors are shearing or cutting teeth (Figure 22). Their major functions are to punch and cut food material during the process of mastication, aesthetics, word articulation (labiodental consonants), and lip support.

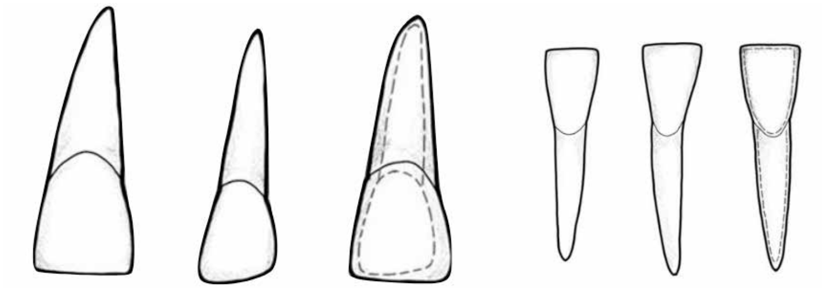


Figure. 22 - Incisors.

MAXILLARY CENTRAL INCISOR

Characteristics

It is the most characteristic tooth of the incisor group; it has a wedge-shaped appearance from a proximal view, and from a free view (buccal and lingual) it has a boat oar appearance. Erupts around 7 to 8 years of age.

Antagonism and Contiguity

- It has an antagonism relationship with the mandibular central incisors and with the mesial half of the mandibular lateral incisors.
- It has a contiguity relationship distally with the mesial face of the maxillary lateral incisor, and mesially with the mesial surface of the maxillary central incisor on the opposite side, and may be separated by a labial frenum causing diastema.

Labial Surface

- Wide trapezoidal shape with a large incisal base, as this trapezoid is narrow at the cervical third and wide at the incisal third. The cervico-incisal dimension is greater than the mesiodistal in a percentage range from 75% to 85%.
- Convex in the cervical third, determining the appearance of the buccal hump; decreases the convexity in the incisal direction from the ridge, being divided into 3 slopes: 1st cervical third inclination after the ridge, flat in the middle third and becoming almost flat, slightly inclined in the incisal third.

- In young teeth, two developmetal grooves start from the ridge and reach the incisal edge. The term edge implies an angle formed by the merging of two flats surfaces, dividing the surface into 3 developmental lobes (Distal>Mesial>Mesial>Distal), consequently, the incisal edge is serrated (lily flower); Due to tooth wear after functional contact, this characteristic tends to disappear.
- Mesioincisal Angle is slightly rounded (almost straight), while the distoincisal angle is well rounded.
- **Edges:**
  - **Cervicalabial:** quite curvilinear and convex to the root.
  - **Distolabial:** oblique and convergent to the root; smaller and more inclined than the mesial; angulates with the distal edge of the root.
  - **Mesiolabial:** oblique and convergent to the root; larger and less inclined than the distal one; straight with the mesial edge of the root.
  - **Labio-Incisal:** more or less straight in young teeth, and becomes distally inclined with wear.

Lingual Surface

- It has a silhouette similar to the labial surface, having a trapezoidal shape;
- It is smaller than the buccal surface, due to the convergence of the proximal to the lingual surfaces;
- The lingual topography gives a scoop-like (concave) form to the crown.
- Mesial and distal marginal ridges border the convexity, the lingual portion of the incisal edge, and the convexity apically to the cingulum.
- The mesial and distal marginal ridges border the lingual fossa laterally.
- It also has 4 edges and 4 angles just like the buccal face.
  - **Linguocervical:** quite curvilinear and convex to the root.
  - **Distolingual:** oblique and convergent to the root; smaller and more inclined than the mesial; angulates with the distal edge of the root.
  - **Mesiolingual:** oblique and convergent to the root; larger and less inclined than the distal one; straight with the mesial edge of the root.
  - **Linguo-incisal:** more or less straight in young teeth, and becomes distally inclined with wear.

Proximal Surfaces

- It has a triangular shape with a cervical base, due to the convergence of the buccal and lingual sides to the incisal.
- It has greater convexity in the incisal thirds (due to the proximal ridges), so the proximal sides touch each other in the incisal thirds, constituting the point of contact. In the remaining two-thirds, it is almost flat or slightly hollowed out.
- The mesial surface is larger and less inclined than the distal surface.
- The hump is on the mesial surface and in the incisal third and the distal middle third.

Borders:

- **Mesio/Distobuccal:** convex in the cervical third due to the presence of the buccal boss, and flat or slightly convex in the rest of its extension.
- **Mesio/Distolingual:** convex in the cervical third by the presence of the cingulate and concave in the remaining two-thirds.
- **Mesio/Distocervical:** curvilinear from concavity to cervical.
- **Mesio/Disto-incisal:** curvilinear and convex to incisal.

Root

- Conical but with a certain degree of flattening mesiodistally.
- Longer than the dental crown.
- Labial, mesiolingual, and distolingual surfaces without precise boundaries, the distolingual surface is sometimes grooved.
- Has a slight distal deviation.
- **Root Canal:** circular in cross-section.
- **Pulp Chamber:** narrow in the labiolingual direction and wide in the mesiodistal direction; ceiling with pulp horns corresponding to the lobes.

MAXILLARY LATERAL INCISOR

Characteristics

It is one of the most variable teeth in human dentition. It supplements the maxillary central incisor in function, and the crowns bear a close resemblance. It is small in all dimensions. Erupts around 8 to 9 years of age.

Antagonism and Contiguity

- It has an antagonism relationship with the distal half of the mandibular lateral incisor and with the mesial half of the mandibular canines.
- It has a contiguity relationship distally with the mesial surface of the maxillary canines, and mesially with the distal surface of the maxillary central incisors.

Labial Surface

- The shape of an elongated trapezoid.
- Convex in the cervical third, determining the appearance of the buccal hump; being that such convexity is greater than in the maxillary central incisor for having smaller dimensions when compared to the central incisor.
- Developmental grooves are deeper, and lobes are a little more evident.
- Distance cervico-incisal > mesiodistal (much greater)
- Appear with a rounded incisal ridge and rounded incisal angles mesially and distally. Mesioincisal is slightly rounded (almost straight), while the distoincisal angle is very rounded.
- **Borders:**
  - **Labiocervical:** smaller and more convex compared to maxillary central incisor as the mesiodistal diameter is smaller.
  - **Distolabial:** smaller and quite sloping.
  - **Mesiolabial:** larger and tends to be more vertical (has a slight slope).
  - **Labio-Incisal:** It can present itself in 2 ways. Rectilinear is quite inclined towards the distal, making the distolincisal angle well rounded, or it can present with a canine appearance, presenting 2 segments, a shorter and straight mesial and a long and rounded distal. It is well reduced on the tooth without wear.

Lingual Surface

- It has a silhouette similar to the labial surface, having an elongated trapezoidal shape.
- It is smaller than the labial surface, due to the convergence of the proximal to the lingual surfaces.
- Very irregular and quite concave due to its small dimensions. The presence

of lingual fossa in the cervical two-thirds of the tooth creates an excavated appearance.

- The marginal ridges, being more evident, better delimit the lingual fossa;
- The cingulum is also very prominent.,
- Because the fossa is deeper and the cingulum is more prominent, it forms an area of poor enamel coalescence, thus allowing the presence of a pit, which occurs not so rarely.
- It also has 4 edges and 4 angles just like the labial face.
  - **Linguocervical:** smaller and more convex compared to maxillary central incisor as the mesiodistal diameter is smaller.
  - **Distolingual:** smaller and quite sloping.
  - **Mesiolingual:** This is larger and tends to be more vertical (has a slight slope).
  - **Linguo-Incisal:** It can present itself in 2 ways. Rectilinear sharply inclined towards the distal, making the DI angle well rounded, or it may have a canine-like appearance, with 2 segments, a shorter and straighter mesial one and a longer, rounded distal one. It is well reduced on the tooth without wear.

Proximal Surface

- It has a triangular shape with a cervical base due to the convergence of the free to incisal faces.
- It has greater convexity in the incisal 1/3 (due to the proximal bosses).
- Ridge on the mesial surface in the incisal third and on the distal surface in the middle distal third
- The mesial surface is larger and less convex than the distal surface.
- **Border:**
  - **Mesio/Distobuccal:** convex in the cervical third due to the presence of the labial ridge, and flat or slightly convex in the rest of its extension.
  - **Mesio/Distolingual:** convex in the cervical 1/3 by the presence of the cingulate and concave in the remaining 2/3.
  - **Mesio/Distocervical:** curvilinear from concavity to cervical.
  - **Mesio/Disto-Incisal:** curvilinear and convexity to the incisal.

Root

- Conical, thin, and flat mesiodistally.
- Longer than the dental crown.
- It is grooved longitudinally.
- Crown-root angle is well inclined towards the distal, with the apex of the root being deviated distally and lingually, which makes it clinically important, as the apical infectious processes drain to the lingual.
- **Root Canal:** circular in cross-section; with reduced dimension
- **Pulp Chamber:** narrow in the labiolingually direction and wide in the mesiodistal direction; ceiling with pulp horns corresponding to the lobes.

DIFFERENCES BETWEEN MAXILLARY INCISORS

	Maxillary Central Incisor	**Maxillary Lateral Incisor**
CROWN	More voluminous	Less voluminous
LABIAL SURFACE	- Flared trapezoidal; - Small disproportion between width and height; - Proximal borders are almost the same size; - Incisal edge slightly inclined distally; - Distoincisal angle slightly rounded.	- Elongated Trapezoidal; - Height steeper than width; - Mesial border much larger than distal and less inclined; - Incisal edge well inclined towards distal or canine shape; - Distoincisal angle very rounded.
LINGUAL SURFACE	- Wide cingulum; - Lingual fossa – shallow and wider; - Rare pit at lingual fossa. - Marginal ridges are only marked.	- Narrow and sharp girdle; - Narrow and deep lingual fossa. - Most common pit at lingual fossa; - Marginal ridges very evident.
PROXIMAL SURFACES	- Being larger in dimension, the characteristics are less evident	- Most evident features
ROOTS	- Conical, bulky and relatively short.	- Conical, flattened Mesiodistal, less bulky and relatively long.

Table. 3 - Comparison of characteristics betweem maxillary incisors.

MANDIBULAR CENTRAL INCISOR

Characteristics

The smallest tooth of the dental arch presents simple morphology. Erupts between 6 and 7 years of age.

Antagonism and Contiguity

- It has an antagonistic relationship with the lingual face of the maxillary central incisor.
- It has a contiguity relationship distally with the mesial surface of the mandibular lateral incisor, and mesially with the mandibular central incisor on the opposite side.

Labial Surface

- The shape of an elongated trapezoid;
- Presents a hump on the cervical third (discrete) giving a convexity on the face in the mandibular canine direction almost flat on the incisal two-thirds;
- The developmental grooves are not as sharp and the developmental lobes are tiny and extinct when there is wear and tear;
- Has a lingual slope;
- Distance cervical-incisively > mesiodistally
- Mesioincisal and distoincisal Angle are predominantly straight.
- **Borders:**
    - **Labiocervical:** has a small radius of curvature and convex to the root;
    - **Distolabial:** slightly converging towards the cervical, with greater inclination, but difficult to be perceived;
    - **Mesiolabial:** discreetly converging to the root and almost without slope; It becomes smaller than the distal when there is the contact of the incisal edge of the mandibular central incisor with the mesial marginal ridge of the maxillary central incisor;
    - **Labio-Incisal:** almost straight; becomes a flat veneer oblique to the mesial side on the worn tooth;

Lingual Surface

- It has a silhouette similar to the labial surface, having a trapezoidal shape.
- It is smaller than the labial surface, due to the convergence of the proximal to the lingual surfaces.
- It has a very discreet height of contour and cingulum on the cervical third giving a discreet convexity and concave on the incisal two-thirds due to the lingual fossa.
- The lingual fossa is quite shallow, limited by the marginal ridges, and slightly marked by the discrete cingulum.
- It also has 4 edges and 4 angles just like the buccal face.
    - **Linguocervical:** has a small adjustment radius and convex to cervical.
    - **Distolingual:** discreetly convergent to the root, with a greater slope, but difficult to perceive.
    - **Mesiolingual:** discreetly converging to the root and almost without slope; It becomes smaller than the distal when there is the contact of the incisal edge of the ICI with the mesial marginal ridge of the ICS;
    - **Linguo-incisal:** almost straight; becomes a flat veneer oblique to the mesial side on the worn tooth.

Proximal surfaces

- It has a triangular shape, due to the convergence of the free faces to the incisal.
- The distal surface is slightly more convex and larger, while the mesial surface is nearly flat.
- *Very discreet proximal ridges*.
- The cervical border (neckline) is concave to the root.
- **Borders:**
    - **Mesio/Distolabial:** slightly convex almost flat.
    - **Mesio/Distoingual:** convex in the cervical 1/3 due to the presence of the hump and cingulate and concave in the remaining 2/3.
    - **Mesio/Distocervical:** curvilinear from concavity to cervical.
    - **Mesio/Disto-Incisal:** curvilinear and convex to incisal.

Roots

- Conical, small, flared labiolingually, and well flattened mesiodistally.
- Longer than the dental crown.
- It is longitudinally grooved on the proximal surfaces; sometimes the grooves are so evident that they often separate the root partially or completely.
- **Root Canal:** follows the shape of the root.
- **Pulp Camera:** narrow in the labiolingually direction and wide in the mesiodistal direction.

MANDIBULAR LATERAL INCISOR

Characteristics

Larger than the mandibular central incisor. Erupts around 7 to 8 years.

Antagonism and Contiguity

- It has an antagonistic relationship with the distal third of the maxillary central incisor and with the mesial half of the maxillary lateral incisor, through the lingual surfaces.
- It has a contiguity relationship distally with the mesial surface of the mandibular canine, and mesially with the distal surface of the mandibular central incisor.

Labial Surface

- The shape of an enlarged trapezoid compared to the mandibular central incisor.
- Sharper, but poorly modeled labial morphology.
- *Ridge on the cervical third (discreet) and almost flat on the incisal two-thirds*.
- Developmental grooves are present, but not as clear;
- *Discrete developmental lobes*;
- Has a lingual slope.
- Distance cervicoincisally > mesiodistally
- The Meioincisal angle is almost straight and the distal incisal angle is more rounded and obtuse.
- **Border:**

- **Labiocervical:** has a small radius of curvature and is convex to the root.
- **Distolabial:** discreetly converging towards the root and with an inclination difficult to perceive, but more evident than in the mesial.
- **Mesiolabial:** discreetly converging to the root and almost no slope;
- **Labio-Incisal:** distally inclined; may have two segments, one mesial and one distal.

Lingual Surface

- It has a silhouette similar to the labial face, having a trapezoidal shape.
- It is smaller than the labial surface, due to the convergence of the proximal to the lingual surfaces.
- *The ridge on the cervical third gives a convexity on the surface, discreetly concave on the incisal two-thirds due to the lingual fossa.*
- *The lingual fossa is slightly more excavated than the mandibular central incisor, however, its anatomical accidents are also unclear, even being more evident than in the mandibular central incisor.*
- It also has 4 edges and 4 angles just like the buccal face.
  - **Linguocervical:** has a small radius of curvature and is convex to the root.
  - **Distolingual:** discreetly convergent to the root, with greater slope, but difficult to perceive.
  - **Mesiolingual:** discreetly converging to the root and almost no slope;
  - **Linguo-Incisal:** distally inclined; has two segments, one mesial and one distal.

Proximal surfaces

- It has a triangular shape, due to the convergence of the free surfaces to the incisal.
- The distal surface is smaller and its convexity is slightly more pronounced than that of the mesial surface.
- *Very discreet proximal ridges*.
- **Borders:**
  - **Mesio/Distolabial:** slightly convex almost flat.
  - **Mesio/Distolingual:** convex in the cervical 1/3 by the presence of the cingu-

late and concave in the remaining 2/3.

- **Mesio/Distocervical:** curvilinear from concavity to cervical.
- **Mesio/Disto-Incisal:** curvilinear and convex to the incisal.

Roots

- Conical, flattened mesiodistally, and longer than mandibular central incisor.
- Longer than the dental crown.
- It is grooved longitudinally, on the proximal surfaces.
- Well-noticed lingual deviation.
- **Root Canal:** follows the shape of the root.
- **Pulp Chamber:** narrow in the labiolingually direction and wide in the mesiodistal direction.

DIFFERENCES BETWEEN MANDIBULAR INCISORS

	Mandibular Central Incisor	Mandibular Lateral Incisor
LABIAL SURFACE	- Elongated trapezoidal shape - Nearly right mesioincisal anddistoincisal angles - Unclear grooves and lobes. - Straight or mesial angled incisal edge	- Flared trapezoidal shape - Mesioincisal and distoincisal angles more rounded - More evident grooves and lobes - Distal angled incisal edge withcaniniform distal segment and incisodistal rounded.
LINGUAL SURFACE	- More elongated and less excavated. Anatomical details just marked.	- Wider and more excavated. Anatomical details are a little moreaccentuated, with cingulate and lingual foramen more evident.
PROXIMAL SURFACES	- Distal surface greater than mesial when there is wear.	- The mesial surface is always largerthan the distal
ROOTS	- Flattened mesiodistal and discreet distal deviation. less and flatter.	- Flattened mesiodistal and more pronounced distal deviation. Largera nd bulkier.

Table. 4 - Comparison of characteristics between mandibular incisors.

DIFFERENCES BETWEEN MAXILLARY AND MANDIBULAR INCISORS

MAXILLARY INCISORS	MANDIBULAR INCISORS
-More voluminous and typically widened trapezoidal crown (from the labial view). -Diameter mesiodistally > labiolingually. - Much sharper modeling of the lingual surface with evident anatomical details. - Beveled incisal edge (from the lingual view). - Mesial and distal edges are more accentuated. - Size order is descending.	- Crownless voluminous, elongated (from the buccal view). - Diameter labiolingually > mesiodistally. - Discreet lingual surface modeling and less distinguishable anatomical details. - Beveled incisal edge (from the buccal view). - Mesial and distal edges only are marked. Size order is ascending.

Table. 5 - Comparison of characteristics between maxillary and mandibular incisors.

CANINES

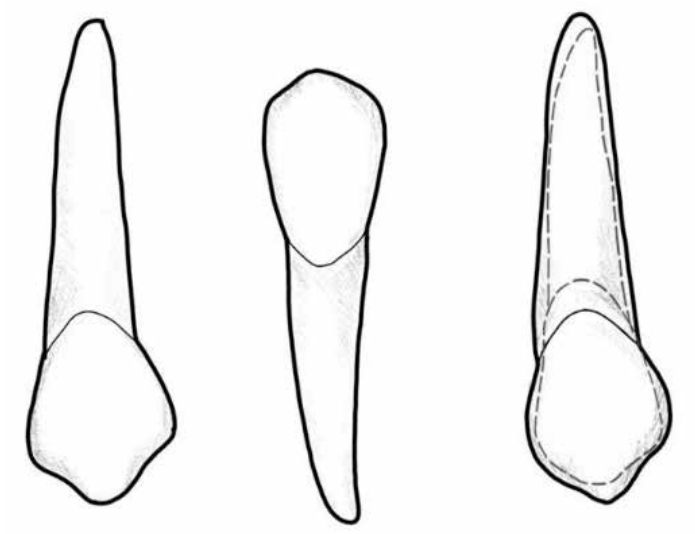


Figure. 23 – Canine

- **Purpose:** shearing food or tearing and reducing food substances to less compact particles.
- **General Characteristics:** There are the longest human teeth, considered with one cusp due to the morphology of their crown. It marks the transition between the incisors and the premolars, where the curvature of the dental arch begins. It has a robust root that forms an elevation in the maxilla and mandible called canine eminence.

MAXILLARY CANINE

Characteristics

It is the longest tooth, one of the most developed in human dentition. Because of the labiolingual thickness of the crown and root and the anchorage in the alveolar process of the jaws, these teeth are perhaps the most stable in the mouth. Erupts around 11 to 12 years of agee.

Antagonism and Contiguity

- It has an antagonism relationship with the distal half of the mandibular canines and with the mesial half of the mandibular first premolar (bicuspid).

- It has a contiguity relationship distally with the mesial surface of the maxillary first premolar (maxillary bicuspid), and mesially with the distal surface of the maxillary lateral incisor.

Labial Surface

- The shape of a pentagon, a lanceolate shape.
- Quite convex in the cervicoincisal and mesiodistal directions.
- Presence of a very voluminous buccal hump in the cervical third. From the ridge, the face becomes a lingual inclined surface.
- The two developmental grooves that start from the ridge and reach the incisal edge are very clear, dividing the face into 3 developmental lobes, being Middle>-Distal>Mesial. Due to the middle lobe being more evident, it causes a convexity in the face in the mesiodistal direction.
- Cervicoincisal distance - mesiodistal (extended), or nearly proportional.
- **Border:**
  - **Labiocervical:** semicircular, with a small radius of curvature and convex to the cervical.
  - **Distolabial:** convergent to the root; smaller and more inclined than the mesial;
  - **Mesiolabial:** convergent to the root; larger and less inclined than the distal one.
  - **Labio-Incisal:** It has a V shape, divided into 2 segments, a smaller and less inclined mesial segment and a larger and greater inclined distal segment. The two segments are separated by a sharp point in the case of a young tooth or by a point that has a flat surface in the case of a worn tooth.

Lingual Surface

- It has a silhouette similar to the labial face.
- It is smaller than the labial surface, due to the convergence of the proximal to the lingual surfaces.
- It has a lingual ridge and a very voluminous cingulum causing a large convexity in the cervical third (proper site for the development of carious lesions).
- From the cingulum, the marginal ridges depart, and there is also a median ridge

that divides the lingual fossa into two.

- May have a pit, but sometimes it's not very evident.
- **Note:** the development of the cingulum can reach such dimensions that a true cusp is formed on the surface.
- It also has 4 edges and 4 angles just like the buccal face.
    - **Linguocervical:** semicircular, of small radius of curvature, and convex to the root.
    - **Distolingual:** converging towards the cervical, smaller and more inclined than the mesial;
    - **Mesiolingual:** converging towards the cervical, larger and less inclined than the distal.
    - **Linguo-Incisal:** V-shaped, divided into 2 segments a smaller and less inclined mesial segment and a larger and greater inclined distal segment. The two segments are separated by a sharp point in the case of a young tooth or by a point that has a flat facet in the case of a worn tooth.

Proximal Surfaces

- It has a triangular shape, due to the convergence of the free faces to the incisal.
- It has greater convexity in the incisal third (due to the proximal ridges).
- Near the cervical area, the proximal surfaces become slightly flat or depressed to maintain the integrity of the interdental papilla that lodges in the interdental space.
- The ridge on the mesial face is located in the incisal third and the ridge on the distal face is located in the middle third.
- The distal surface is smaller and much more convex than the mesial surface.
- The mesial surface is flatter, less excavated in the cervical 1/3 and, with a more discreet model.
- **Borders:**
    - **Mesio/Distolabial:** convex at the cervical 1/3 due to the presence of the vestibular ridge.
    - **Mesio/Distolingual:** convex in the cervical 1/3 due to the presence of the ridge and cingulate and concave in the remaining 2/3 due to the presence of the lingual trench.

- **Mesio/Distocervical:** concave to cervical.
- **Mesio/Disto-Incisal:** convex to incisal.

Root

- It is the biggest dental root.
- Oval, but with a slight degree of flattening mesiodistally.
- Longer than the dental crown.
- There are mesial and distal grooves, but they are discrete.
- Has a distal deviation.
- **Root Canal:** circular in cross-section.
- **Pulp Chamber:** wide in the labiolingually direction and narrow in the mesiodistal direction.

MANDIBULAR CANINE

Characteristics:

It is a slender and more elongated tooth. Erupts around 9 and 10 years of age.

Antagonism and Contiguity:

- It has an antagonism relationship with the distal half of the maxillary lateral incisors and with the mesial half of the maxillary canines.
- It has a contiguity relationship distally with the mesial surface of the mandibular first premolar (mandibular bicuspid), and mesially with the distal surface of the mandibular lateral incisor.

Labial Surface:

- The shape of a pentagon or lanceolate.
- It has a labial ridge on the cervical third giving greater convexity on the face.
- Two longitudinal developmental grooves start from the vestibular ridge in the cervical third, but they are not very clear, and divide the face into 3 developmental lobes (Middle labial lobe>Distal>Mesial). Due to the Middle labial lobe being more evident, it causes a convexity in the face in the mesio-distal direction.
- After the ridge, the surface is quite lingually inclined.

- Distance cervicoincisal > mesiodistally, and therefore considered longer.

- **Borders:**
  - **Labiocervical:** convex to cervical.
  - **Distolabial:** converging to the cervical; smaller and more inclined than the mesial;
  - **Mesiolabial:** converging to the cervical; larger and less inclined than the distal;
  - **Labio-Incisal:** V aspect (V-shaped), like maxillary canine; however, it has a greater slope of the segments.

Lingual Surface

- It has a silhouette similar to the Labial Surface.
- It is smaller than the labial surface, due to the convergence of the proximal surfaces towards the lingual.
- Presence of lingual ridge, cingulum, marginal ridges, lingual fossa, but few marked;
- Absence of pit.
- also has 4 Borders and 4 Angles just like the labial Surface.
  - **Linguocervical:** convex to the cervical.
  - **Distolingual:** converging to the cervical; smaller and more inclined than the mesial;
  - **Mesiolingual:** converging to the cervical; larger and less inclined than the distal;
  - **Linguo-Incisal:** V aspect like CS, but has a greater slope of the segments.

Proximal Surface:

- It has a triangular shape due to the convergence of the free faces to the incisal.
- Slightly convex at incisal third (due to proximal ridges).
- The mesial surface is larger and less inclined than the distal surface.
- The distal face is smaller and less inclined than the mesial surface.

- **Borders:**
  - **Mesio/Distolabial:** convex at the cervical 1/3 due to the presence of the vestibular ridge.
  - **Mesio/Distolingual:** convex in the cervical 1/3 due to the presence of the ridge and cingulum, concave in the remaining 2/3 due to the presence of the lingual trench.
  - **Mesio/Distocervical:** concavity for the cervical.
  - **Mesio/Disto-Incisal:** convex to incisal.

Root

- Conical, elongated, and flattened mesiodistally;
  - **Note:** due to the high degree of mesiodistal flattening, the root canal may be bifurcated, and the existence of root rigidity apex.
- It has a distal deviation.
- **Root Canal -** follows Root's external morphology.
- **Pulp Chamber -** wide in the labiolingual direction and narrow in the mesiodistal direction.

DIFFERENCES BETWEEN MAXILLARY AND MANDIBULAR CANINES

	Maxillary Canine	**Mandibular Canine**
Labial Surface	- Sharp mesiodistal distance, flared face. - More accentuated developmental grooves and sharper lobes. - More divergent proximal Borders due to greater slope of the faces. - More globular silhouette. - More vertical face. - Incisal edge with 2 slightly inclined segments.	- Shorter mesiodistal distance, elongated face. - Less marked developmental grooves and less visible lobes. - Less divergent proximal Borders. - Slimmer silhouette. - Face quite lingually inclined. Incisal edge with 2 highly inclined segments.
lingual Surface	- Sharper modeled. - More evident cingulate and marginal ridges. - Most common pit - Presence of the middles ridge.	- Modeled more discreet. - Less marked cingulate and marginal ridges. - Absent pit. - Middle ridge absent
proximal Surface	- Mesial surface more convex forming a very wide angle with the root. - Distal surface well marked in its anatomical details. Quite convex.	- Flatter mesial surface and barely perceptible angle, continuing with the Root. - Flatter distal surface and much less accentuated details.

root	- Conical, very long, and with discrete proximal grooves.	- Flatter, less bulky, and evident mesiodistal grooves. - Most frequent bifidity.

THE LATERAL MOVEMENT OF THE JAW:

- **Canine Guide:** occurs during the lateral movement of the mandible, the canines on the working side touch each other throughout the movement, which causes the disocclusion of all other elements.
- **Group Function:** occurs during the lateral movement of the mandible, the canines and premolars on the working side touch each other throughout the movement, which causes the disocclusion of all other elements.

As far as mandibular kinetics are concerned, the working side of the mandible is the opposite side of the muscle undergoing contraction. The working side of the teeth is the side for which contact between the canines is occurring. That is, there is a release or sliding of the mandible to one side, with progressive relaxation of the side opposite to the one undergoing action. Therefore, when we refer to the working side and the balancing or non-working side, we project that there is a harmonic movement either for contraction or relaxation.

PREMOLARS

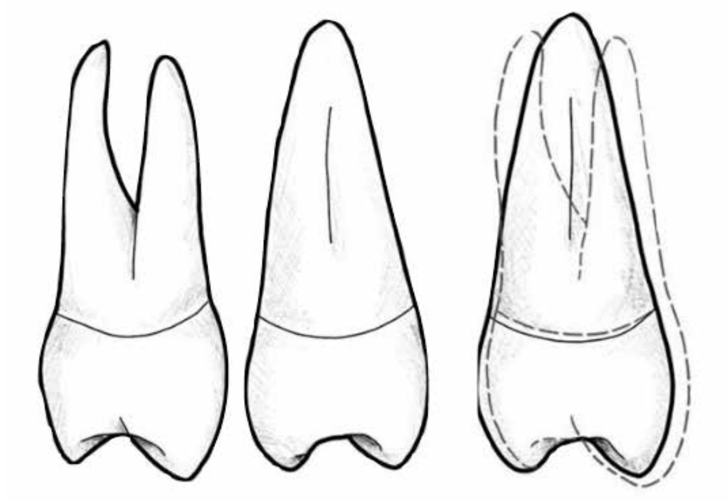


Figure. 24 – Maxillary Premolar

- **Purpose:** crushing the food, maintaining the vertical dimension of the face, preventing introflexion, and supporting the corner of the mouth.
- **General Characteristics:** are bicuspid teeth that mark the transition between canines and molars, are not present in deciduous teeth and have as their predecessor the deciduous molars. While Maxillary premolars are in descending order in the mesiodistal sense, mandibular premolars are in ascending order, following the Curve of Spee.

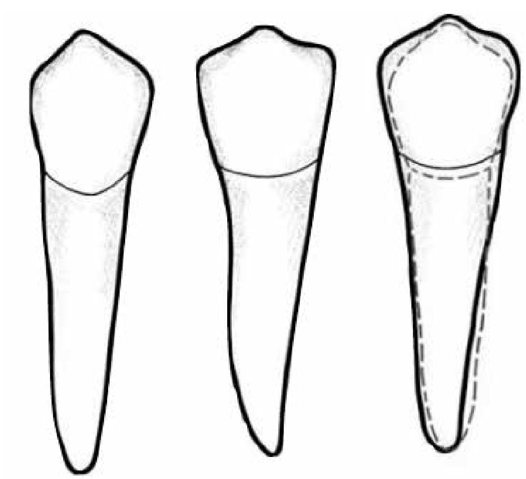


Figure. 25 –Mandible Premolar

1ST MAXILLARY PREMOLAR

Characteristics

It is the most voluminous of the premolar group. Erupts between 10 and 11 years of age.

Antagonism and Contiguity

- It has an antagonism relationship with the distal half of the mandibular first premolar and with the mesial half of the mandibular second premolar.
- It has a contiguity relationship distally with the mesial surface of the maxillary second premolar, and mesially with the distal surface of the maxillary canines.

Buccal Surface

- Similar to upper canine, but ¼ smaller.
- The shape of a pentagon.
- Quite convex in the cervico-occlusal and mesiodistal directions.
- Presence of a very voluminous vestibular ridge in the cervical third. From the ridge, the face becomes a downward and lingual sloping surface.
- It has two not very clear developmental grooves that start from the ridge and reach the incisal edge, dividing the face into 3 developmental lobes, being Middle>Distal>Mesial, due to the middle buccal lobe being the most prominent, the Buccal Surface is convex in the direction distomesially.
- Cervico-occlusal distance - mesiodistal (extended)
- **Borders:**
    - **Buccocervical:** semicircular, with a small radius of curvature and convex to the cervical.
    - **Distobuccal:** converging to the cervical; smaller and more inclined than the mesial;
    - **Mesiobuccal:** converging to the cervical; larger and less inclined than the distal.
    - **Bucco-Occlusal:** V-shaped, having a LONGER, less sloping mesial segment and a SMALLER, more sloping distal segment. (Remember that the mesial segment is always smaller in canines and other premolars).

Lingual Surface

- It has a silhouette similar to the Buccal Surface.
- But smaller than the Buccal Surface, due to the convergence of the Proximal Surface to the lingual.
- Quite convex in the CO and MD direction.
- *Linguo ridge at cervical third; from this ridge, the face leans to the labial side*.
  - **Linguocervical:** semicircular, with a small radius of curvature and convex to the cervical.
  - **Distolingual:** converging to the cervical; smaller and more inclined than the mesial;
  - **Mesiolingual:** converging to the cervical; larger and less inclined than the distal.
  - **Linguo-occlusal:** V-shaped, having a smaller, less inclined mesial segment and a larger, more inclined distal segment.

Proximal Surface

- It has a trapezoidal shape.
- Stretched in the direction of buccal-lingual.
- The distal face is smaller and more convex than the mesial.
- On the mesial surface, there is a prolongation of the main sulcus of the occlusal surface, forming a marked depression in the cervical 1/3 and parallel to the medial contact area, bordered by the ML and MV angular lines and continuous apically towards the root called papillary**.**
  - Clinical application - protection of the periodontium against the mechanical action of the food bolus due to different curvatures of the buccal and lingual surfaces of the crown.
- Poor convergence towards occlusal, (buccal and lingual Borders are nearly parallel, but still converge towards occlusal).
- Mesial ridge at the middle third or the junction of the middle and occlusal third; Distal ridge in the middle third, more towards cervical.
- The cusps have their vertices projected within the contours of the roots, that is, the distance between the vertices of a cusp is less than the distance buccal-lingual from the root.
- **Borders:**

- **Mesio/Distobuccal:** convex in the cervical 1/3 due to the presence of the buccal ridge, being larger than the lingual edge.
- **Mesio/Distolingual:** convex in the cervical 1/3 due to the presence of the lingual ridge, being smaller than the buccal edge.
- **Mesio/Distocervical:** concavity for the cervical.
- **Mesio/Disto-occlusal:** aspect of a circumflex accent with a truncated apex, which corresponds to the marginal ridge.

Occlusal Surface

- Irregular trapezoidal shape or irregular hexagon, with a labial base (due to the accentuation of the Buccal Surface, so that there is a great convergence of the Proximal Surface towards the lingual).
- 2 cusps: buccal and lingual; Separated by the main groove (which begins and ends in two pits, mesial and distal) in the mesiodistal direction.
- The main groove is rectilinear and paracentral moving more lingually, which makes the buccal cusp more voluminous (when looking at the tooth in profile, it is noticed that this cusp is also higher). This inequality in the volume of the cusps allows for a more accurate identification of the tooth.
- Presence of well-developed marginal ridges, the mesial ridge being usually furrowed by the extension of the main groove.

Roots

- 70% of cases are bifid (different from 2nd Maxillary Premolar).
- Quite wide in the buccal-lingual direction on its cervical 2/2, while the apical third is fully bifurcated.
- Buccal root > Lingual root.

2ND MAXILLARY PREMOLAR

Characteristics

Similar to maxillary first premolar, but with reduced dimensions. Erupts between 10 and 12 years of age.

Antagonism and Contiguity

- It has an antagonism relationship with the distal half of the mandibular second premolar and with the mesial half of the mandibular first molar.
- It has a contiguity relationship distally with the mesial face of the maxillary first molar, and mesially with the distal face of the maxillary second premolar.

Buccal Surface

- Similar to maxillary first premolar, but slightly smaller in every way.
- The shape of a pentagon.
- Very convex in the cervico-occlusal and mesiodistal directions.
- Presence of a very voluminous vestibular ridge in the cervical third. From the ridge, the face becomes a downward and lingual sloping surface.
- It has 2 developmental grooves and 3 developmental lobes being Middle>Distal>Mesial. Because the Middle is more voluminous, the tooth is convex in the mesiodistal direction.
- The distance cervico-occlusal dimension is greater than that mesiodistally.
- **Borders:**
    - **Buccocervical:** semicircular, with a small radius of curvature and convex to the cervical.
    - **Distobuccal:** converging to the cervical; smaller and more inclined than the mesial;
    - **Mesiobuccal** converging to the cervical; larger and less inclined than the distal one.
    - **Bucco-Occlusal:** it is V-shaped, having a smaller, less inclined mesial segment, and a larger, more inclined distal segment.

Lingual Surface

- It has a silhouette similar to the buccal surface.
- Height is almost equal to the buccal surface, being a more symmetrical tooth.
- Convex in the cervico-occlusal and mesiodistal direction.
- Lingual ridge on the cervical third; from this ridge the face leans towards the buccal side.

- **Borders:**
  - **Linguocervical:** semicircular, with a small radius of curvature and convex to the cervical.
  - **Distolingual:** converging to the cervical; smaller and more inclined than the mesial;
  - **Mesiolingual:** converging to the cervical; larger and less inclined than the distal.
  - **Linguo-occlusal:** has a "V" shape, having a smaller, less inclined mesial segment and a larger, more inclined distal segment.

Proximal Surface

- It has a trapezoidal shape.
- Stretched in the buccal-lingual direction.
- The distal face is smaller and more convex than the mesial.
- Similar to the proximal surface of the maxillary first premolar, however, the small groove on the mesial surface is rarely noticed due to the prolongation of the main groove of the Occlusal Surface, so there is no presence of a papillary pocket.
- Little convergence towards occlusal, (buccal and lingual Borders are nearly parallel, but still converge towards occlusal).
- *Mesial ridge at the middle third or the junction of the middle and occlusal 1/3; and distal ridge in the middle third more towards cervical*.
- **Borders:**
  - **Mesio/Distobuccal:** convex at the cervical 1/3 due to the presence of the buccal ridge.
  - **Mesio/Distolingual:** convex in the cervical 1/3 by the presence of the lingual ridge.
  - **Mesio/Distocervical:** concavity for the cervical.
  - **Mesio/Disto-occlusal:** aspect of a circumflex accent with a truncated apex, which corresponds to the marginal ridge.

Occlusal Surface

- Regular hexagonal or regular trapezoidal shape, with a buccal base (due to the accentuation of the Buccal Surface, so that there is great convergence of the

Proximal Surface towards the lingual).

- It has 2 cusps, one buccal and one lingual, separated by the main groove (which starts in the mesial pit and ends in a distal pit) in the mesiodistal direction. The central groove is rectilinear and central, making the two cusps have a similar volume. Small secondary grooves can break from this groove, giving the tooth a wrinkled appearance on the cusps.
- Presence of well-developed marginal ridges.

Roots

- 80% of cases are unique (different from Maxillary 1st premolar).
- Well-grooved and flat MD.

DIFFERENCES BETWEEN MAXILLARY FIRST AND SECOND PREMOLARS

	Maxillary 1st premolar	**Maxillary 2nd premolar**
Crown	- Bulkier.	- Less bulky.
Root	- More voluminous and bifid.	- Smaller, and when double, they are glued together.
Occlusal Surface	- Buccal cusp much larger than the lingual cusp. - Paracentral MD groove. - atypical hexagonal shape.	- Buccal cusp slightly larger than lingual cusp. - Central mesiodistal groove. - Hexagonal or ovoid shape.
Proximal Surface	- Buccal and Lingual cusps are of unequal length when viewed proximally. - Grooved mesial face.	- Buccal and Lingual cusps are nearly identical in length. - Mesial face rarely grooved
Buccal Surface	- More evident anatomical details. - Mesial segment of occlusal edge longer than distal.	- Less obvious anatomical details. - Mesial segment of occlusal edge smaller than distal.

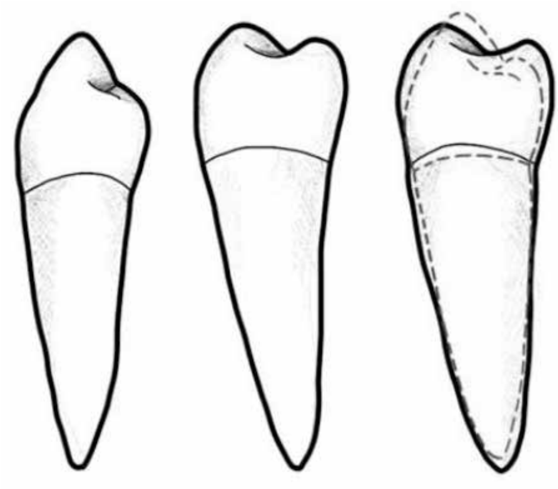


Figure. 25 – Mandible Premolar

1ST MANDIBULAR PREMOLAR

Characteristics

Erupts between 10 and 12 years of age.

Antagonism and Contiguity

- It has an antagonism relationship with the distal half of the maxillary canine and with the mesial half of the maxillary first premolar.
- It has a contiguity relationship distally with the mesial face of the mandibular second premolar, and mesially with the distal face of the mandibular canine.

Buccal Surface

- The shape of a pentagon.
- Very convex in the cervico-occlusal and mesiodistal directions.
- Presence of a very voluminous vestibular ridge in the cervical third. From the ridge, the face becomes a flatter surface and is lingually inclined. The inclination is so steep that the tip of the buccal cusp corresponds to the axis of the tooth.
- The two developmental grooves are smoother and start from the ridge and reach the occlusal edge dividing the face into 3 developmental lobes (Middle>Distal>Mesial).

- Cervico-occlusal distance ≅ mesiodistal (extended).
- **Borders:**
  - **Buccocervical:** semicircular, with a small radius of curvature and convex to the cervical.
  - **Distobuccal:** converging to the cervical; smaller and more inclined than the mesial.
  - **Mesiobuccal** converging to the cervical; larger and less inclined than the distal.
  - **Bucco-occlusal:** has a circumflex shape, having a smaller, less sloping mesial segment and a larger, more sloping distal segment.

Lingual Surface

- It has a silhouette similar to the Buccal Surface. However, it is much smaller than the Buccal Surface, and in general, very reduced to the point of being able to atrophy and it becomes a cingulum similar to anterior teeth. (Fundamental feature for recognition).
- Quite convex in the cervico-occlusal and mesiodistal direction.
- *Lingual Ridge is in the middle third*.
- **Borders:**
  - **Linguocervical:** semicircular, with a small radius of curvature and convex to the cervical.
  - **Distolingual:** converging to the cervical; smaller and more inclined than the mesial;
  - **Mesiolingual:** converging to the cervical; larger and less inclined than the distal.
  - **Linguo-occlusal:** has a circumflex shape, having a smaller, less sloping mesial segment and a larger, more sloping distal segment.

Proximal Surface

- It has a rhomboidal shape, thanks to the great inclination that the occlusal edge of the Proximal Surface is lingual.
- Stretched in the buccal-lingual direction.
- The distal surface is smaller and more convex than the mesial.
- Ridge is more or less pronounced in the occlusal third, however, in the rest of

the tooth, these surfaces are slightly depressed and quite converging towards the cervical.

- **Borders:**
  - **Mesio/Distobuccal:** convex at the cervical third due to the presence of the vestibular ridge.
  - **Mesio/Distolingual:** convex in the middle third by the presence of the lingual ridge
  - **Mesio/Distocervical:** concavity for the cervical.
  - **Mesio/Disto-occlusal:** V-shaped aspect with truncated apex, which corresponds to the marginal ridge.

Occlusal Surface

- Circular or oval shape,
- 2 buccal and lingual cusps are separated by the main groove (which is constantly interrupted by a sharp enamel bridge that transforms the main groove into two deep pits one mesial and one distal) of mesiodistal direction.
- This main groove is very curved with concavity towards the buccal and paracentral moving more towards the lingual, which makes the buccal cusp more voluminous and sharper, while the Lingual cusp is small, shorter, and sometimes absent, being replaced by a tubercle.
- Presence of well-developed marginal ridges.

Roots

- It is usually single; however, it can be bifid due to the high degree of flatness it has.

2ND MANDIBULAR PREMOLAR

Characteristics

It may have three or two cusps. Erupts between 11 and 12 years of age.

Antagonism and Contiguity

- It has an antagonism relationship with the distal half of the maxillary first premolar

and with the mesial half of the maxillary second premolar.

- It has a contiguity relationship distally with the mesial face of the mandibular first molar, and mesially with the distal face of the mandibular first premolar.

Buccal Surface

- Similar to mandibular first premolar, but higher.
- When having three cusps, the buccal surface is smaller than the lingual.
- The shape of a pentagon.
- Very convex in the cervico-occlusal and mesiodistal directions.
- Presence of a very voluminous vestibular ridge in the cervical third. From the ridge, the face becomes a flatter surface and is lingually inclined.
- It has 2 developmental grooves that separate 3 developmental lobes being Middle>Distal>Mesial.
- Distance Cervico-occlusal ≅ mesiodistal (extended)
- **Borders:**
    - **Buccocervical:** semicircular, with a small radius of curvature and convex to the cervical.
    - **Distobuccal:** converging to the cervical; smaller and more inclined than the mesial;
    - **Mesiobuccal** converging to the cervical; larger and less inclined than the distal one.
    - **Bucco-occlusal:** It has the shape of a circumflex accent, having a smaller and less inclined mesial segment and a larger and more inclined distal segment.

Lingual Surface

When bicuspid

- It has a similar silhouette to the Buccal Surface but is smaller than the Buccal Surface.
- The lingual ridge in the middle third, after the ridge the face is smooth and sloping labially.
- **Bordos**

- **Linguocervical:** semicircular, with a small radius of curvature and convex to the cervical.
- **Distolingual:** converging to the cervical; smaller and more inclined than the mesial;
- **Mesiolingual:** converging to the cervical; larger and less inclined than the distal one.
- **Linguo-occlusal:** it has the shape of a circumflex accent, having a smaller and less inclined mesial segment and a larger and more inclined distal segment.

When Tricuspid

- There are 2 cusps: a greater mesial cusp and a lesser distal cusp separated by a small groove, the lingual groove.
- Quite convex in the Cervico-occlusal and mesiodistal direction.
- Linguo ridge in the middle third.
- **Borders:**
    - **Linguocervical:** semicircular, with a small radius of curvature and convex to the cervical.
    - **Distolingual:** converging to the cervical; smaller and more inclined than the mesial;
    - **Mesiolingual:** converging to the cervical; larger and less inclined than the distal one.
    - **Linguo-occlusal:** it has the shape of a circumflex accent, having a smaller and less inclined mesial segment and a larger and more inclined distal segment.

Proximal Surface

- It has a rhomboidal shape, thanks to the great inclination of the occlusal edge of the Proximal Surface towards the lingual.
- Convex in the buccal-lingual direction.
- The distal face is smaller and more convex than the mesial.
- Ridge is more or less pronounced in the occlusal third.

- **Borders:**
  - **Mesio/Distobuccal:** convex in the cervical 1/3 due to the presence of the lingual ridge.
  - **Mesio/Distolingual:** convex in the middle 1/3 by the presence of the linguo ridge
  - **Mesio/Distocervical:** concavity to cervical.
  - **Mesio/Disto-occlusal:** "V" aspect with truncated apex, which corresponds to the marginal ridge.

Occlusal Surface:

When bicuspid

- Circular contour
- 2 cusps: buccal and lingual.
- Mesiodistal main sulcus, the sulcus being quite curved, concavity towards buccal and paracentral ending in two triangular pits.

When Tricuspid

- Quadrangular contour
- 3 cusps: buccal cusp, mesiolingual cusp distolingual cusp;
- Separated by the main mesiodistal groove and by an occlusal-lingual groove that is less accentuated and perpendicular and goes towards the lingual surface of the tooth;
- The two grooves can be shaped like the letter Y.
- Presence of well-developed marginal ridges.

Roots

- It usually has only one root.
- Wider and more conical.

DIFFERENCES BETWEEN MANDIBULAR FIRST AND SECOND PREMOLAR

	Mandibular 1st premolar	**Mandibular 2nd premolar**
Crown	- Less bulky	- Bulkier.
Occlusal Surface	- Ovoid or circular. - Poorly developed lingual cusp. - Marked lingual inclination. - Curved main groove, almost always interrupted, and para-central. - Features enamel bridge.	- Ovoid or quadrilateral. - More developed lingual cusp, which can be divided into 2. - Discreet lingual inclination. - Curved main groove, central. - Does not present enamel bridge.
Lingual Surface	- Reduced to the point of looking like a tubercle. - It does not have a lingual groove. - Only 1 cusp on the lingual	- More developed, when tri gets to be bigger than the vestibular. - Has a lingual groove - When tri has 2 cusps on the lingual.

DIFFERENCES BETWEEN MAXILLARY PREMOLAR AND MANDIBULAR PREMOLAR

	Maxillary Premolar	**Mandibular Premolar**
Volume	- Larger, with a predominance of the VL distance. - Descending order (1st > 2nd)	- Smaller, with a predominance of the MD distance. - Ascending Order (2nd > 1st)
Root	- Conical, simple or bifid.	- Flat, grooved and simple.
Occlusal Surface	- Hexagonal. - Rectilinear main groove. - Always bicuspid.	- Ovoid. - Curvilinear main groove. - Uni, bi or tricuspid.
Free Surfaces	- Lingual surface well developed. - Vertical Buccal.	- Poorly developed lingual surface. - Buccal surface inclined to the lingual side.

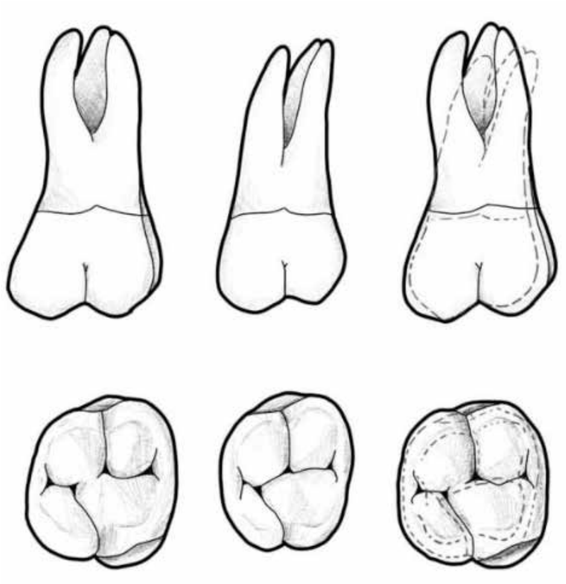


Figure. 26 – 1st Maxillary Molar

MOLARS

- **Purpose:** these teeth are used to perform the major portion of the work in the mastication and comminution of food. Also, they maintain the vertical dimension of occlusion, filling the cheek.
- **General Characteristics:** generally speaking, the molars have large crowns with four-well-formed cusps. For the maxillary ones, the bucco-lingual distance is greater than the mesio-distal, while in the mandibular arch, they always have four or five cusps, and the mesio-distal distance is greater than the bucco-lingual. The permanent molar is not a succedaneous tooth because it has no predecessor; the premolars are the succedaneous teeth for deciduous molars.

1ST MAXILLARY MOLAR

Characteristics

It has no deciduous predecessor as it is the first permanent tooth that erupts without exfoliation of a deciduous tooth, parents should be warned that around 6 years of age this tooth erupts. The tooth has the highest rate of caries of all the teeth. Erupts at 6 years of age. It has a cuboidal crown, being wider than it is tall, due to the mesiodistal and buccal-lingual distances being greater than the cervico-occlusal.

Antagonism and Contiguity

- It has an antagonistic relationship with the mandibular first molar and with the mandibular second molar.
- It has a contiguity relationship distally with the mesial surface of the maxillary second molar, and mesially with the distal surface of the maxillary second premolar.

Buccal Surface

- Trapezoidal shape.
- Convex in all directions.
- It is smaller than the Lingual Surface.
- Ridge on the cervical third.
- It has the buccal development groove that separates the distobuccal cusp from the mesiobuccal cusp.
- **Borders:**

- **Buccocervical:** rectilinear, formed by two curved segments of concavity facing the Root, separated by an enamel tip (clinical reference of the bifurcation of the buccal roots, important in the tooth extraction).
- **Proximal:** quite convergent towards the root; the mesial being larger and less inclined than the distal; Note the silhouette of the proximal ridge that is close to the occlusal.
- **Bucco-occlusal:** has a 2 ''V'' shape, having a BIGGER and well open mesial ''V'' segment and a MINOR and more closed distal "V" segment, whose apex corresponds to the tips of the cusps; has such a shape due to the buccal groove which is a continuation of the buccal development groove, and which ends in a triangular pit in the middle third of the surface.

Lingual Surface

- It has a silhouette similar to the Buccal Surface.
- It is larger than the Buccal Surface.
- More convex than the Buccal Surface.
- Lingual ridge at cervical third.
- It has a tubercle of Carrabelli, a supplemental cusp. This morphological trait can take the form of a well-devoloped fifth cusp, or it can grade down to a series of grooves, depressions, or pits on the mesial portion of the lingual surface.
- It has a disto-lingual groove originating from the distal pit of the Occlusal Surface, separating the mesio-lingual and disto-lingual cusps.
- **Borders**:
  - **Linguocervical:** consisting of a slightly curved and concave segment for the occlusal surface;
  - **Proximal:** quite convergent for Root; the mesial being larger and less inclined than the distal; Note the silhouette of the proximal ridge that is close to the occlusal.
  - **Linguo-occlusal:** has a 2 ''V'' shape of quite a different size, having a BIGGER and well open mesial ''V'' segment and a SMALL and more closed distal ''V'' segment, whose apices correspond to the tips of the cusps, has Such a shape due to the lingual groove that divides the face into these two segments, this groove and continuation of the disto-lingual groove that starts at the occlusal surface and ends at the lingual surface, does not reach the middle third of this face, ending smoothly without building a triangular depression as in the buccal.

Proximal Surface

- It has a trapezoidal shape.
- Greater convexity in the occlusal third due to the presence of proximal ridges.
- The distal face is smaller and more convex than the mesial.
- Wider faces of the crown.
- **Borders:**
  - **Mesio/Distobuccal and Lingual**: quite convex, the lingual being more accentuated despite the buccal ridge being more developed.
  - **Mesio/Distocervical:** concavity towards the cervical, and not very accentuated.
  - **Mesio/Disto-occlusal:** a form of an apex circumflex truncated by the marginal ridges.

Occlusal Surface

- Rhomboidal shape.
- Four cusps **(Mesiolingual>Mesiobuccal>Distobuccal>Distolingual)**
- Except for the distolingual cusp, the others present the slopes well separated by occlusal or axial edges, which start from the rounded tips of the cusps and go obliquely towards the intercuspid grooves. On the sides of the occlusal ridges and slightly parallel to them, there are small grooves on the occlusal slopes of the cusps which indent further into the occlusal surface. These grooves tend to disappear with the progressive physiological wear of the teeth.
- **Grooves:**
  - **Occlusalbuccal groove:** separates the buccal cusps (mesiolingual from distobuccal); it starts from a central triangular pit and goes to the Buccal Surface, ending in a small pit situated in the middle third of this surface.
  - **Distolingual groove:** separates the lingual cusps (mesiolingual from distolingual); part of the distal triangular pit and runs obliquely to the Lingual Surface and ends on this face.
  - **Mesio-central groove:** separates the mesiobuccal and mesiolinguo cusps; it originates in the central pit and runs to the mesial triangular pit.

* It is frequently interrupted by the presence of an enamel bridge that connects the mesiolingual cusp to the distobuccal, obliquely crossing the occlusal surface.

Note: the three grooves may be linked together by the presence of another inconstant sulcus which, starting from the central pit, will meet the disto-lingual sulcus having formed a letter H;

- Presence of well-developed marginal ridges.

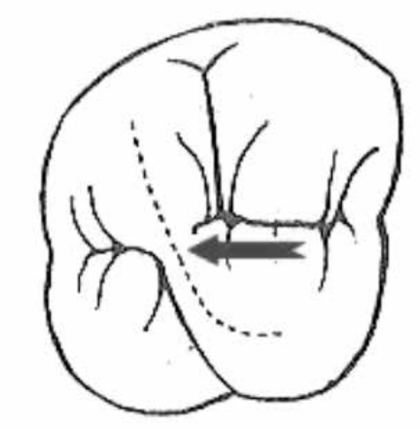


Figure. 27 – 1st Maxillary Molar

Roots:

- Three roots = Linguo>mesiobuccal>distpbuccal
- The three roots of generous proportions are mesiobuccal, distobuccal, and lingual. The lingual root is the longest. The mesiobuccal root is not as long, but it is broader buccolingually and shaped (in cross-section) so that its reistance to torsion is grater than that of the lingual root. The distobuccal root is the smallest of the three and is smoothly rounded.
- Deviations are more accentuated in the buccal roots.

2ND MAXILLARY MOLAR

Characteristics:

It has no deciduous predecessor and erupts at 12 years of age. It has a cuboidal crown, being wider than it is tall, due to the mesiodistal and buccal-lingual distances being greater than the cervico-occlusal.

Antagonism and Contiguity

- It has an antagonistic relationship with the mandibular second molar and, when present, the mandibular third molar.
- It has a contiguity relationship distally with the mesial surface of the maxillary third molar (when present), and mesially with the distal surface of the maxillary first molar.

Buccal Surface

- Trapezoidal shape.
- Convex in all directions, (more than maxillary first molar).
- It is larger than the Lingual Surface, (difference from maxillary first molar).
- Buccal ridge on the cervical third.
- The buccal groove separates the mesiobuccal from the distolingual cusps.
- **Borders:**
  - **Cervical:** straight, formed by two curved segments with a concavity facing the Root, separated by an enamel tip (clinical reference of the bifurcation of the vestibular Roots, important in the extraction of the element).
  - **Proximal:** quite convergent to the Root; the mesial being larger and less inclined than the distal; Note the silhouette of the proximal ridge that is close to the occlusal.
  - **Occlusal:** V-shaped, having a bigger and less inclined mesial segment and a small and more inclined distal segment; has such a shape due to the vestibular sulcus which is a continuation of the occlusal-buccal sulcus, and which ends in a triangular pit in the middle third of the surface.

Lingual Surface

- Has a silhouette similar to the Buccal Surface.
- Smaller than the Buccal Surface.
- More convex than the Buccal Surface.
- Lingual ridge at cervical third.
- The distolingual groove is even closer to the distal surface, and the intensity of this displacement makes the tooth tricuspid.

- **Borders:**
  - **Linguocervical:** consisting of a slightly curved and concave segment for the Occlusal Surface;
  - **Proximal:** quite convergent for Root; the mesial being larger and less inclined than the distal; Note the silhouette of the proximal ridge that is close to the occlusal.
  - **Linguo-occlusal:** has a 2 ''V'' shape of quite a different size, having a bigger and well open mesial ''V'' segment and a small and more closed distal ''V'' segment, whose apices correspond to the tips of the cusps, has such a shape due to the lingual groove that divides the face into these two segments, this sulcus and continuation the distolingual sulcus that starts at the occlusal surface and ends at the lingual surface, does not reach the middle third of this face, ending smoothly without building a triangular depression as in the vestibular.

Proximal Surface

- Trapezoidal shape.
- Greater convexity in the occlusal third due to the presence of proximal ridges.
- The distal face is smaller and more convex than the mesial.
- Wider faces of the crown.
- **Borders:**
  - **Buccal and Lingual:** quite convex, the lingual being more accentuated despite the buccal ridge being more developed.
  - **Cervical:** concavity towards the Root, and not very accentuated.
  - **Occlusal:** A form of a circumflex accent truncated by the marginal ridges.

Occlusal Surface

- Oval Shape
- Four cusps (Mesiolingual>Mesiobuccal>Distobuccal>Distolingual) > the Occlusal Surface is a repeat of the 1MS, however, the enamel bridge is less frequent and the Distolingual cusp is smaller; this occurs in 30 to 40% of the cases.
- Three cusps (Lingual>Mesiobuccal>Distobuccal) are more frequent, around

50% of cases; the crown is reduced due to the loss of the distolingual cusp, this fact occurs simultaneously with the distal displacement of the mesiolingual cusp that ends up constituting the entirety of the lingual surface; presents a deep groove: mesiodistal, which starts in the mesial pit and ends in the distal pit and has in its intermediate part the central pit from where the occlusal-buccal groove starts.

- Compression Form > undergoes simultaneous compression in borders distobuccal and mesiolingual; its crown adopts the ellipsoid aspect when viewed by the Occlusal Surface; its cusps are confused by the bad delimitation of these and the furrows that separate them; occurs around 10 to 20%.
- Presence of well-developed marginal ridges,

Roots

- Three roots = Lingual>Mesiolinguo>Distobuccal
- Deviations are less pronounced than in the maxillary first molar.

DIFFERENCES BETWEEN MAXILLARY FIRST MOLAR AND MAXILLARY SECOND MOLAR

	Maxillary first molar	**maxillary second molar**
Crown	- Bulkier	- Slightly smaller than that of the maxillary first molar.
Root	- 3 well-developed roots.	- 3 Less developed roots.
Occlusal Surface	- Usually four cusps - Presence of enamel bridge.	- Usually three cusps - Broken enamel bridge.
Lingual Surface	- Larger than the buccal. - Carrabelli's tubercle present in 71.5% of cases.	- Always smaller than the buccal. - Rare Carrabelli's tubercle.

1ST MANDIBULAR MOLAR

Characteristics

It has no deciduous predecessor. It is the most voluminous tooth, normally presenting 5 cusps. It has a cuboidal crown, being wider than it is tall, due to the mesiodistal and buccal-lingual distances being greater than the cervico-occlusal. It erupts around 6 to 7 years old.

Antagonism and Contiguity

- It has an antagonistic relationship with the maxillary first molar and the maxillary second premolar.
- It has a contiguity relationship distally with the mesial face of the mandibular second molar, and mesially with the distal face of the mandibular second premolar.

Buccal Surface

- Trapezoidal shape.
- Convex in mesiodistal and cervico-occlusal directions.
- It has a very accentuated lingual inclination.
- Buccal ridge on the cervical third.
- Buccal groove that separates the mesiobuccal and distobuccal cusps.
- **Borders:**
  - **Cervical:** the smooth curve of convexity facing the Root, separated by an enamel tip (clinical reference of the bifurcation of the vestibular roots, important in the extraction of the element).
  - **Proximal:** convex and very inclined towards the anatomical neck, the distal being smaller than the mesial.
  - **Occlusal:** V-shaped having a longer, less sloping mesial segment, a median segment, and a small, sloping distal segment; has such a shape due to the mesiobuccal grooves that it is a continuation of the occlusobuccal groove, and which ends in a triangular pit in the cervical third of the face and distobuccal which is more discreet and ends smoothly in the middle third without constituting a depression.

Lingual Surface

- It has a silhouette similar to the buccal surface.
- It is smaller than the buccal surface.
- More convex than the buccal surface.
- It has a lingual ridge in the middle third.
- Lingual groove divides the lingual cusps into mesiolingual and distolingual.

- **Borders:**
  - **Cervical:** the smooth curve of convexity facing the Root, separated by an enamel tip (clinical reference of the bifurcation of the vestibular Roots, important in the extraction of the element).
  - **Proximal:** convex and very inclined towards the anatomical neck, the distal being smaller than the mesial.
  - **Occlusal:** V-shaped having a longer, less sloping mesial segment, a median segment, and a small, sloping distal segment; has such a shape due to the occlusal-lingual groove that starts from the occlusal pit and ends in a triangular pit on the middle 1/3 of the face.

Proximal Surface

- Trapezoidal shape.
- Greater convexity in the occlusal third due to the presence of proximal ridges. And slightly hollowed out in the remaining thirds.
- The distal face is smaller and more convex than the mesial, in addition to having a more accentuated pattern.
- Wider faces of the crown.
- **Borders:**
  - **Vestibular and Lingual:** quite convex.
  - **Cervical:** concavity towards the Root, and not very accentuated.
  - **Occlusal:** V-shaped with well-opened branches, with apex truncated by marginal ridges.

Occlusal Surface

- Trapezoidal shape.
- Most have five cups. (Mesiolingual>Mesiobuccal>Distolingual>Distobuccal>Distal)
- Presence of very evident marginal ridges.
- **Grooves:**
  - **Mesiodistal main groove:** starts and ends in the mesial and distal pits; forms a broken or slightly sinuous line. It separates the buccal and lingual cusps, and is interrupted by a mesiocentral pit and a distal-central pit.
  - **Occlusalbuccal groove:** separates the mesiobuccal and buccal-median

cusps; part of a central triangular pit and leads to the Buccal Surface, ending in a small triangular pit on this face.

- **Occlusal-lingual groove:** separates the mesiolingual and disto-lingual cusps, part of the central or disto-central pit, and, heads towards the Lingual Surface ending in the middle third of this surface.
- **Disto-vestibular groove:** separates the distobuccal and distal cusps; part of the distal pit and runs to the buccal surface ending in the occlusal 1/3 of that face. It is located slightly oblique to the main groove.

Roots

- Biradicular = Mesial > Distal
- Flat mesiodistally, grooved.
- Deviations are more pronounced in the distal root, while the mesial root is slightly larger and wider.

2ND MANDIBULAR MOLAR

Characteristics

Erupts around age 11 to 13.

Antagonism and Contiguity

- It has an antagonism relationship with the maxillary second molar.
- It has a contiguity relationship distally with the mesial face of the mandibular third molar (when present), and mesially with the distal face of the mandibular first molar.

Buccal Surface:

- Trapezoidal shape.
- Convex in the mesiodistal and cervico-occlusal directions.
- After the buccal ridge, the face has a very accentuated lingual inclination.
- It has a buccal groove that ends in a buccal pit located on the third of this face. This groove separates the cusps into mesiobuccal and distobuccal.

- **Borders:**
  - **Cervical:** the smooth curve of convexity facing the Root, separated by an enamel tip (clinical reference of the bifurcation of the vestibular Roots, important in the extraction of the element).
  - **Proximal:** convex, the distal being smaller than the mesial.
  - **Occlusal:** it has the shape of a circumflex accent, having a bigger and less inclined mesial segment and a smaller and more inclined distal segment; has such a shape due to the buccal sulcus which is distinct and continuation of the occlusal-buccal sulcus, and which ends in a triangular pit in the middle third of the face.

Lingual Surface

- It has a silhouette similar to the buccal surface.
- It is smaller than the buccal surface.
- More convex than the buccal surface.
- Tongue ridge in the middle third.
- The lingual sulcus separates the mesiolingual and distolingual cusps.
- **Borders:**
  - **Cervical:** the smooth curve of convexity facing the Root, separated by an enamel tip (clinical reference of the bifurcation of the vestibular Roots, important in the extraction of the element).
  - **Proximal:** convex, the distal being smaller than the mesial.
  - **Occlusal:** it has the shape of a circumflex accent, having a bigger and less inclined mesial segment and a smaller and more inclined distal segment; has such a shape due to the lingual groove that it is distinct and continuation of the occlusal-lingual groove, and that it ends in the middle 1/3 of the face.

Proximal Surface

- Trapezoidal shape.
- Greater convexity in the occlusal third due to the presence of proximal ridges. And slightly hollowed out in the remaining thirds.
- The distal face is smaller and more convex than the mesial, in addition to having a more accentuated pattern.

- Wider faces of the crown.
- **Borders:**
  - **Vestibular and Lingual:** quite convex.
  - **Cervical:** concavity for Root, and not very sharp.
  - **Occlusal:** V-shaped with well-opened branches, the apex truncated by the marginal ridges.

Occlusal Surface

- Rectangular shape.
- Most have four cusps. (Mesiolinguo>Mesiobuccal>Distobuccal>Distolinguo)
- Main groove with cruciform shape.
- Presence of well-developed marginal ridges.
- There are 3 pits: one mesial and one distal with a triangular shape, and a central one with a diamond shape and well accentuated.
- **Sulcus**:
  - **Mesiodistal sulcus:** begins and ends in the mesial and distal pits; forms a broken or slightly sinuous line. Separates the vestibular from the lingual cusps.
  - **Bucco-lingual sulcus:** separates the mesial and distal cusps; crosses with the mesiodistal sulcus giving a cruciform appearance to the tooth.

Roots

- Biradicular = Mesial > Distal
- Flat mesiodistally, grooved.
- Deviations are more pronounced in the distal root, while the mesial root is slightly larger and wider.

DIFFERENCES BETWEEN THE MANIBULAR FIRST AND SECOND MOLARS

	Mandibular 1st molar	Mandibular 2nd molar
Crown	- Bulkier	- Slightly smaller
Root	- 2 well-developed roots.	- 2 Roots with smaller development and slenderer.
Occlusal Surface	- Usually 5 cusps visible. - W-shaped main groove.	- Usually 4 cusps visible. - Cruciform main groove.
Buccal Surface	- Usually 4 cusps visible. - Cruciform main groove.	- Slightly larger than the lingual.

DIFFERENCES BETWEEN MAXILLARY MOLARS AND MANDIBULAR MOLARS

	Maxillary molars	Mandibular molars
Crown	- More developed in the buccal-lingual direction.	- More developed in the mesiodistal sense.
Root	- 3 Roots.	- 2 Roots.
Occlusal Surface	- 3 or 4 cusps. - Trapezoidal shape.	- 4 or 5 cusps. - Rectangular shape.
Buccal Surface	- More verticalized.	- Quite lingually inclined.

CONCLUSION

After this booklet, the reader should be able to accomplish several tasks as follows. First, list the appropriate age(s) concerning the developmental chronology of the human dentition. Secondly, demonstrate a knowledge of the morphology of each surface of the crown, as well as the root, of each tooth by: describing and/or interpreting a diagram to identify or name any of the following features: contours and margins of any surface; structural entities such as grooves, pits, ridges, inclined planes, cusps, fossae, lobes; the height of contour and contact areas; relative dimensions and shape; a n d any other surface feature. Lastly, the reader should be able to make comparisons between the general characteristics of the teeth, including function, arch position, and distinguishing features, and determine the correct number of each tooth, either in Universal Numbering System or the International Method.

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